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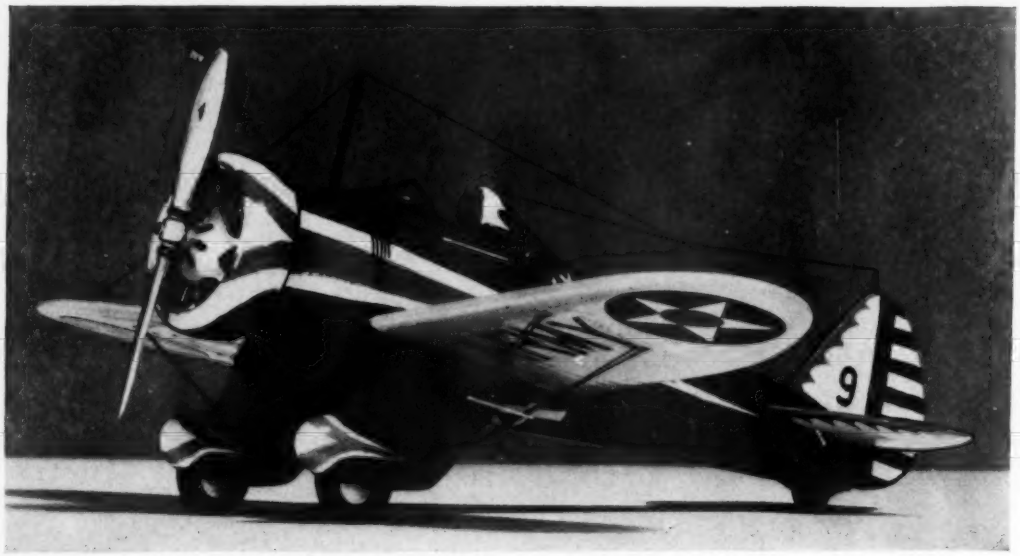

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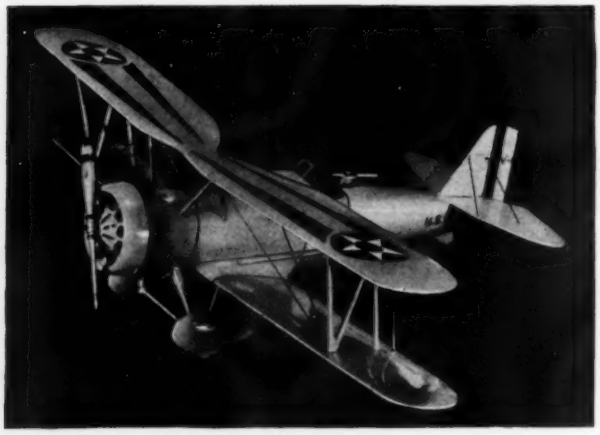

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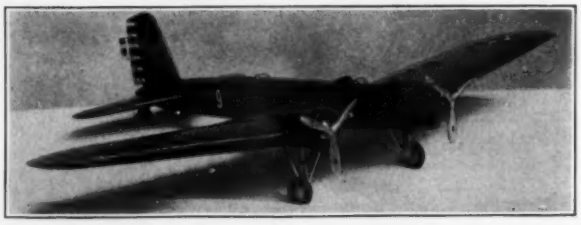

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Model AIRPLANE News

7th YEAR OF PUBLICATION

VOL. XIV *NO. 1*

Edited by Charles Hampson Grant

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In Our Next Issue

"Fool Proof" Planes, by H. Latane Lewis II, gives you the inside story of the struggle to produce a cheap safe plane for the average citizen, as well as data on planes built with this idea in mind.

Virgil Sturiale gives complete instructions to build one of the most detailed flying scale models we have ever presented, in **A Flying Scale "Leopard Moth."**

At last **"Gas Lines"** is born to give gas model fans news and useful information about their favorite hobby.

Secrets of "Indoor" Design, by Herbert Greenberg gives many practical suggestions regarding the design of indoor ships which have been found helpful through long experience.

An Experimental Pusher-Tractor, by A. Charles Mueller, provides you with complete information to construct an interesting experimental model of unique design and flying ability.

The Navi-Goid continues to teach the principles of navigation and prepares you for the big contest to appear shortly.

There are also many other interesting and instructive articles; such, as, **How to Design Your Model Planes, Frontiers of Aviation, a Set of Instrument Board Patterns, Air Ways, Aviation Advisory Board** and **How to Build the Grumman Fighter** that appears on the cover, by Bob McLarren. You cannot afford to miss these building blocks of your aviation career.

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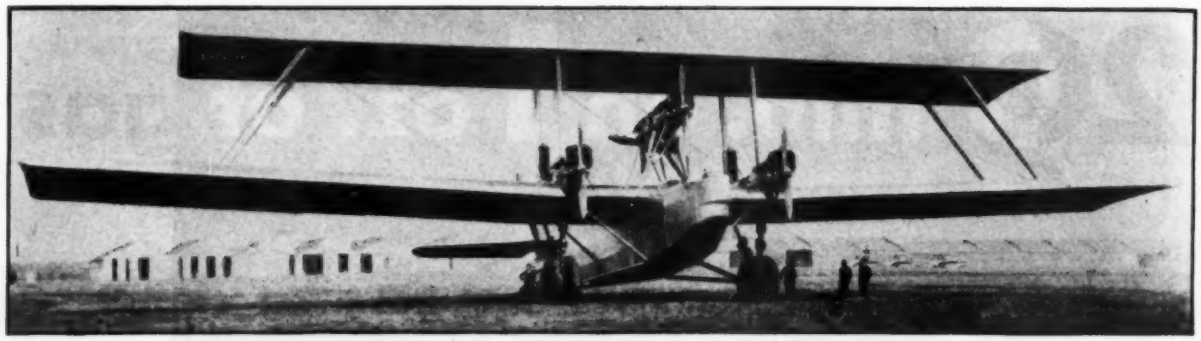


The Caproni Ca-90 with six 1000 hp. engines and a span of 152 ft. Note the size of the men

War Birds

Distinctive Features of Italian Compare With the Latest War

By FLETCHER PRATT and HAROLD B. MARTIN

WHILE the newspapers are all chattering about the advance of the Italians into the heart of Ethiopia, the bombing of Dessye and other spots, and the exploits of the "Desperate Squadron," people interested in military aviation have been wondering just how good the Fascist air army is. Certainly it's a lot better than the six planes that Ethiopia can put into the air—but how would it stack up against the fleet of a first class air power, like that of England, France or the United States?

There are reports that the huge numbers of Italian planes that appear in the statistical sheets represent old equipment that in any other force would long ago have been driven off to the junk-pile, outworn designs and abandoned models. But General Mitchell was saying the same thing about our own air force only the other day—so what does it all amount to? The fact is that any air service in the world necessarily included a lot of machines that are well behind the latest developments in flying fighters, and for the very good reason that it's easier to build one experimental plane than four or five hundred just like it.

The Fiat AR-30, latest observation fighter, powered with an 850 hp. Fiat engine

The Piaggio P-11 Fighter

The Savoia-Marchetti S-66 Transport powered by three 1000 hp. Isotta engines

Piaggio P-10 (naval obs'v'n) with 650 hp. Jupiter

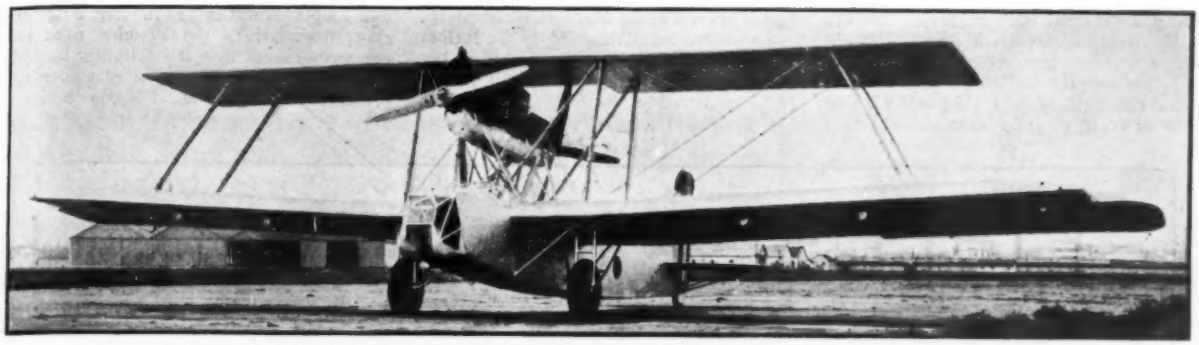
The most modern fighters in the Italian service are three in number, and none of them is yet in quantity production. One of them is a Savoia-Marchetti, a single-seater seaplane, bearing the number S-67. It is designed for service among the numerous islands of Italy's Mediterranean possessions, both around the main peninsula of the country and in the Aegean, and as these islands are nearly all mountainous with no more than a pocket-handkerchief of clear land, it is a hydro. It is recognizable at once because of its typical Savoia construction, all-wood, with the engine overhead. The power is furnished by a single 400 hp. Fiat engine and the craft is rated as having a top speed of 162 m.p.h. Its armament consists of two machine-guns which can operate together or separately, the trips being located at the stick so that the pilot is in control of his ship even when firing. Like all the Savoias, this ship is remarkable for its cruising range.

A leading land fighter is the Breda 27, which is almost exactly like the Boeing P-26A, though the performance figures seem to show the American craft is slightly better in design. The 700 hp. Fiat engine, according to Italian sources, gives it a top speed of 236 m.p.h. After one of these ships was exhibited at the 1st Paris Air Show, French officials gave it a test and announced that the top speed was 211 m.p.h. The French, however, are not exactly the friendliest critics of Italian design and probably the real figure is above that they give out; but in any case Italian planes, designed to work over a country that is nearly all mountains and surrounded by an ocean barrier, must meet conditions not encountered by other air services, and are designed for such conditions.

The third new ship in the Italian air force is the two-seater reconnaissance fighter turned out by Fiat. This plane bears the designation AR-30 and is furnished with a Fiat engine which develops 850 hp. at 15,000 feet. It can be reasonably compared to the new Vought SBU-1, which is a combination scout fighter and light bomber. The SBU-1 has a 750 hp. engine and turns out 228 m.p.h. at 10,000 feet, while the AR-30 is rated at only 213 m.p.h. at the same elevation.

In a recent flight from Fiume to Rome, about 322 miles, the new Fiat ship averaged 238 m.p.h., according to a recent article in an Italian magazine. The same article admits that the weather conditions were ideal and the ship had a tail-wind most of the flight.

Most of the remaining Italian fighters and observation planes resemble World War designs, which may mean either that the Italian World War designs were very



Caproni bomber Ca-74 with two 400 hp. Asso engines. It is one-half as effective as U. S. bombers

# of Italy

Military Aircraft and How They Planes of the United States

good or that the modern planes are not so hot, probably the former. Italy is without attack ships, leaving the business of ground strafing to its fighters, but that is not surprising in view of Italian geography and the ruling ideas of Italian air strategy. Any enemy who attacks Italy must either come through the Alps or across the ocean. Obviously an attack plane is not much use on the high seas and it is almost equally obvious that there is not going to be much ground strafing with machine-guns among the ravines, precipices and glaciers of the Alps.

Italian bombers run to the well-known Caproni types, which were famous even during the World War as huge weight carriers, very reliable, with great range, but heavy on the stick. The largest now in service is a descendant of those early Capronis which flew across the Alps and raided Vienna in the greatest single air-raid of the war. It is a Caproni, the Ca-90, with a wingspread of 152 feet, length of 88 feet, and needing 6 engines of 1000 hp. each. The rated speed is 127.4 m.p.h. and the ceiling is reported as only 14,500 feet. The useful load is 30,070 pounds, over 15 tons, to a radius of a thousand miles. This ship needs a very large flying field and its base would probably always be a target for smaller and lighter enemy bombers.

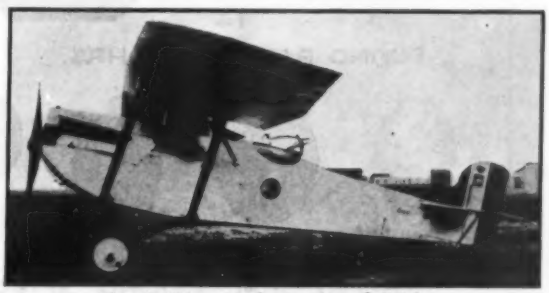
Compared with the American Boeing 290, the figures of the Ca-90 look weak, for the Boeing ship's performance figures show it can carry 22,000 pounds of bombs at an estimated speed around 250 m.p.h. But it must be borne in mind that the Italian craft is operating under radically different conditions; in the first place European gasolines, with which its figures are made, are not generally as good as American gasolines, and this is particularly true of the fuels met with in ordinary service. In the second place, the Capronis, due to Italy's position, are intended to fly in big squadrons over sea or just over the Alps, where range and speed are not so important as reliability and the size of the cargo.

The smaller Caproni Bombers are more like those met with in other countries, and numbers of them are in service in Ethiopia. They have given a good account of themselves under the adverse conditions there, with constant operation at high altitudes, hot sun, and poor landing fields the main difficulties. It seems odd that the Italians have experimented so little with controllable pitch propellers, which would seem well adapted to the conditions. Perhaps the basic reason why the Italians have not adopted this type of propeller lies in the equipment of their motors for high altitude work. Studies have been carried on for several years in both the Isotta and Fiat works on this subject, heavy motors being tested to destruction in the huge wind-tunnels there under low temperatures and pressures such as would be encountered at a level of 40,000 feet, and the design changes suggested incorporated in new motors.

Among observation planes the Italian standard equipment is the Breda 16 at present, powered with an Italian-built Bristol "Jupiter" engine of 650 hp. It is rated as a 127.7 m.p.h. ship, which is a long way behind the 226 m.p.h. of the new Douglas O-46 or the 218 m.p.h. of the Curtiss O-40B. However, speed is not the whole story with an observation plane and it is important to remember that the Bredas did very well in the grueling Tour of Europe air races where many faster ships failed to finish.

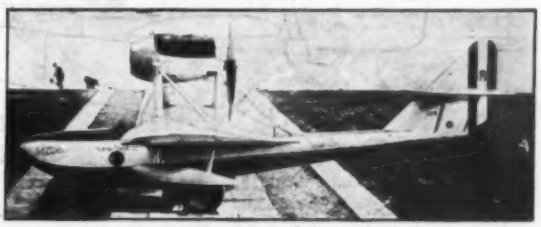
The same story is told by the Italian seaplanes. Everyone remembers Balbo's flotilla and their splendid mass flights, across the Atlantic to Brazil, and then across it again to Chicago. The Savoias of that flight are still in service, being used as transports by several air lines operating between Italy and her African colonies. They are not bombers, of course; the bomber adaptation of the Savoia S-55 design

The Caproni Ca-125 trainer with a Columbo S-6-3-125 hp. engine. It is very efficient



Fiat A-120 scout observation of 650 hp.

Caproni Ca-97R bomber with 550 hp. Asso engine



Savoia Marchetti S-67 fighter of 400 hp.

being a different looking ship. But the S-55 could be converted into a torpedo plane without any great difficulty, and it seems that the Italian naval air strategists contemplate just this use of that type of craft, torpedo bombing holding a high place in Fascist ideas of air strategy.

An interesting plane used by the Italian navy aboard their heavy cruisers is the Piaggio P-10. Outside the United States, Italy is probably the only country that has developed a good single-float catapult seaplane, and this is it. The Piaggio ship is similar to the Voughts used in our navy except that it is slightly larger and has seats for three. The power is furnished by a 700 hp. Piaggio engine,

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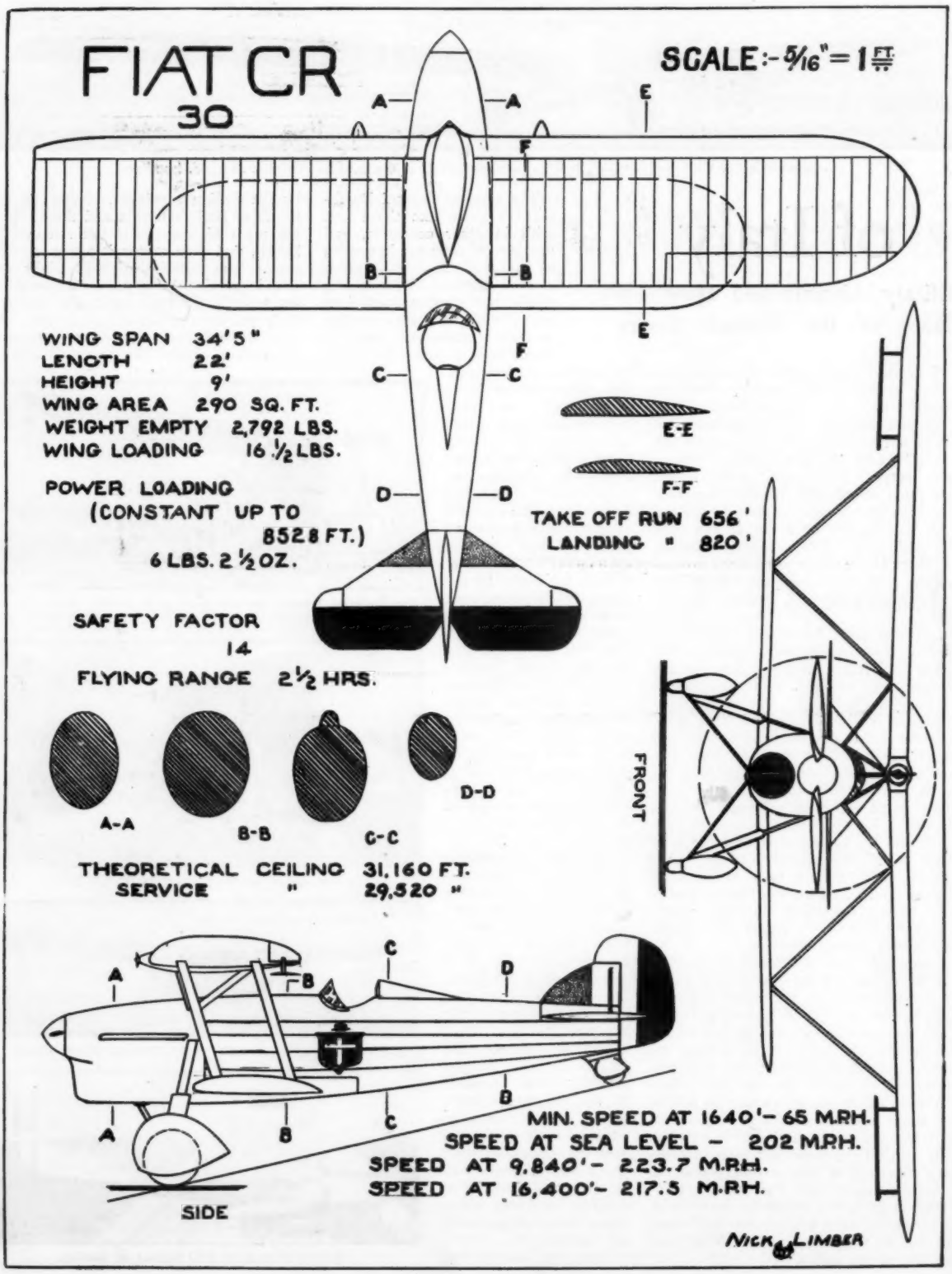


"GAS LINES"

A Monthly Presentation of Who's Who in Gas Model Airplane Designing, Building and Flying. Do Your Part—Tell Other Readers What You Are Doing

This is the gas model builders' section of MODEL AIRPLANE NEWS. You can make it valuable and interesting to your fellow gas model fans by contributing news, ideas, pictures and accounts of how you have solved your problems in this field, to its columns. How well it will serve you depends on how you yourself respond.

SINCE Maxwell Bassett exhibited his gas motored model plane in 1932 at the Atlantic City National Model Airplane Competition, the interest in this new means of experimenting with problems of aviation has spread like wild-fire. The proverbial "snowball" is being licked to a standstill. Every new day brings additional enthusiasts into the fold of gas model fans.

Anyone who has built and flown a "gas" model knows the fascination by means of which this sport holds its followers. That long pent-up desire to experiment with motors and planes finds a fertile field in which to plant the seeds of self-expression. From them a rich harvest of recreation, knowledge and aeronautical wisdom is sure to result.

However, in order to aid the development of this activity, an exchange of ideas among its adherents is imperative. At present each "gas" model fan is surrounded by a world of knowledge built up through his own experience or through the experience of intimate friends. There are hundreds of such fans throughout the world, each with some knowledge that would be helpful to other fans. Therefore, in order that a free exchange of ideas may take place with the ultimate result of an increase in knowledge of each individual, "Gas Lines" has been born. In its "Lines" each month "gas" modelers will read what the "other fellow" is thinking and doing.

We therefore urge everyone interested in this sport to contribute some news, pictures or features of interest and value so that through this exchange the aeronautical knowledge of those who will rule aviation in the future will be developed to a high degree. With all of this, greater joy and interest will come to each individual.

In order to have a clear idea as to the extent of the interest in "gas" models, MODEL AIRPLANE NEWS printed a blank coupon headed, *"Gas Model History,"* in the January issue. The response was overwhelming, and gave assurance of co-operation of a large number of model builders. Many sent pictures of their ships of which a few appear here.

Bob Knapton of 1406 West 105th Street, Los Angeles, Calif., has been one of the many gas model fans who has sent us data concerning his experiments. He has developed one of the most unusual ships that we have seen to date. It is a small thirty-six inch wing span biplane powered with a "Hungerford Mighty Midget" motor. It weighs complete with motor, coils, batteries, etc., one and a half pounds. Bob Knapton is the designer of the plane and W. C. Hungerford of Los Angeles built the motor.

Hungerford is shown holding the little ship in the first picture on page 7. The bore of the motor is 7/16" with a stroke of 7/16". It has a rotary valve and turns 9000 revolutions per minute. The ship is an exceedingly fine flier and has a flight duration of twenty-two minutes to its credit up to the present time. Approximately three eye-droppers full of fuel were required for the flight.

Apparently motor designers are getting the gasoline engine down to the size where they may be put in "models" of the dimensions of ordinary "rubber" models. We are sure that every gas model fan will feel that it is a real achievement in designing and building a motor of this diminutive size. We hope that Knapton and Hungerford will let us know more about their activities.

One of the most active groups of gas model builders in the vicinity of New York is under the able guidance of Mr. Allen Turner. Several models built by young men of this club are shown in the second picture. The uncovered Stinson Reliant was built by Mr. Turner himself. The young men of this club have been consistent winners in contests in which they have entered. Among the members of the club is John Re of Franklin Square, New York, third place winner at the Bamberger Meet, Open Class, recently. Turner may be reached at 2023 Eastern Parkway, Brooklyn, New York.

The fourth picture shows Mrs. Cecelia Turner with the gas model which she built and with which she won the distinction of being the first woman gas model champion. She flew her ship at the Bamberger Meet for about six minutes. It was very cloudy and the ceiling was only about 200 feet. After this time the ship disappeared in the fog.

In the third picture is shown J. Trefny of 380 Linden Street, Glen Ellyn, Illinois, with his ten foot span gas job. The plane boasts of a KG wing and tail group with rubber ball wheels. It weighs six and a half pounds and is powered with a Brown Junior engine. Trefny says that the glide is thirteen to one. So far he

W. C. Hungerford holding a neat biplane built by Bob Knapton, in which is mounted a midget motor which he designed. The ship has flown for 22 minutes

A group of gas jobs built by model fans under the tutelage of Allen Turner. One was built by Mrs. Turner

J. Trefny and his 10 foot span gas job. It has rubber ball wheels

Cecelia Turner and her gas model with which she won the woman's championship

A neat biplane gas model built by Bob Miller, with a span of 8 feet

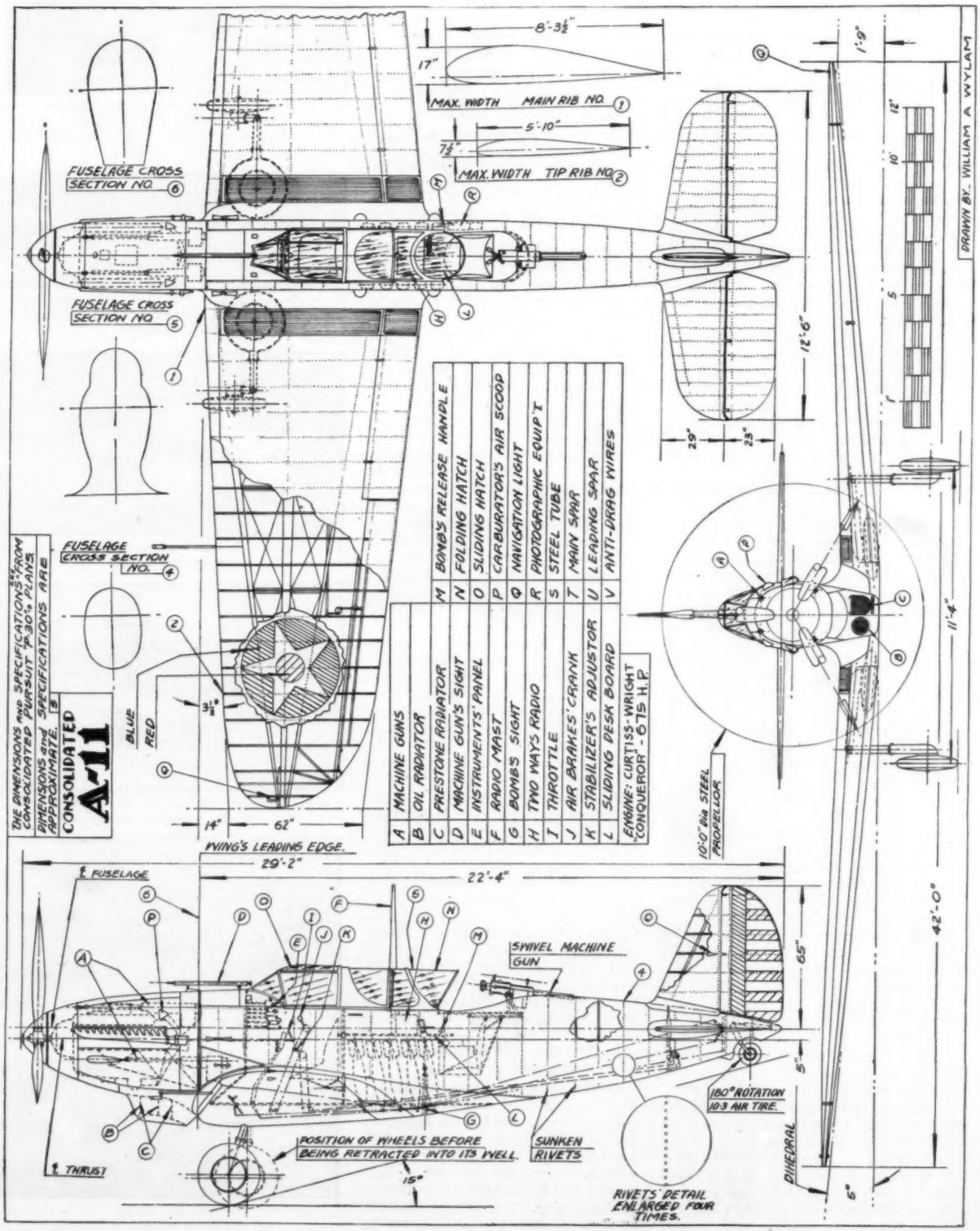
Lester Ohse and his gas model. It is the only ship in Ohse's section of Florida

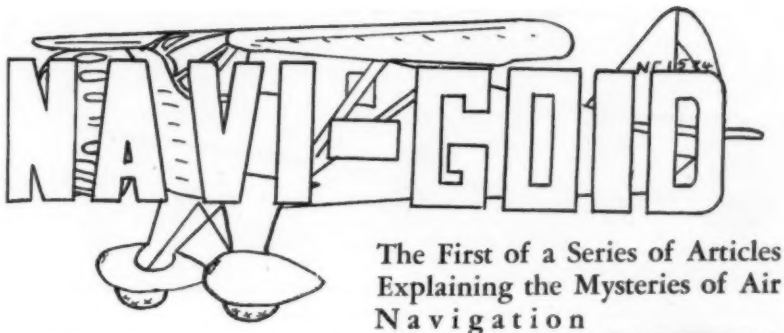
has only been in a position to make short flights, which were successful, however.

The fifth picture shows a neat and unusual biplane built by Robert "Baron" Miller of R.R. 6, Box 454, Webster Groves, Missouri. The ship has a span of eight feet and a chord of twelve inches. The weight is 4¾ pounds. It is built of balsa and is covered with bamboo paper. Miller says that it flies exceedingly well, developing a speed of about 25 miles per hour.

Lester Ohse of 521 Anderson Street, Orlando, Florida, is shown in the sixth picture with his gas job. He tells us that this model is the first gas job in his part of the state. It has a span of seven and a half feet and is powered with a Brown Junior engine. He tells us that the first flight was successful, although

(Continued on page 46)

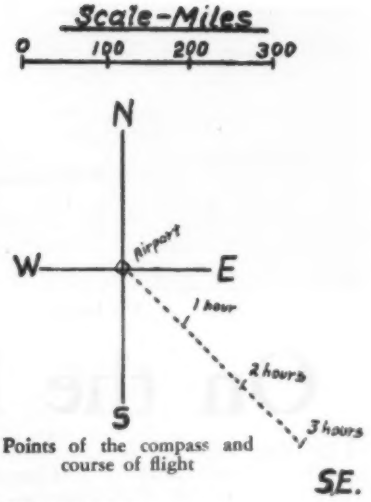




The First of a Series of Articles Explaining the Mysteries of Air Navigation

Which Will be Embodied Later in a Grand Navigation Contest

By E. SEMLER



Points of the compass and course of flight

The Sperry Artificial Horizon and Bank Indicator

Climb-Level Laterally

Dive-Level Laterally

Author's Note:

The distinct objective of this and the two following articles is to familiarize the reader with the instruments and the correct aerial navigation procedure necessary to arrive at the solution of each NAVI-GOID, a contest which will commence in three months. May I suggest that you preserve these three articles for reference during the contest activities as you will find them the simplest guide available. The NAVI-GOID contest, itself, is a taste of the intricate thrills of aerial navigation, offering an aeronautical problem in an interesting and instructive manner, giving a map for the basis of your calculations, and periodical data as the flight progresses.

THE wind blasted rain into the office as the door swung open. Heavy drops that splattered like bombs when they struck the floor. A tall figure in a leather jacket swung into the room and slammed the door.

"Hello, Nicky," Wilkens, the traffic supervisor, greeted the new arrival from his desk. "Hope you don't have weather like this for your flight."

Captain Nicholas Carroll smiled as he slipped from his dripping jacket. It was a companionable smile that seemed to bring a freshness and blitheness into the room.

"Nope," he retorted, "Conditions are reported excellent . . . with the exception of 'low' areas along the Bahamas." His eyes fell on the flight-geared figure at the weather map. "Say, Joe, I thought number three was grounded."

The pilot at the map finished his observations and strolled towards the door, pulling on his helmet. He shrugged his shoulders in reply to the Captain's question.

"Instructions were changed," Wilkens explained, "Cleveland is clearing up. Best of luck, Joe."

"So long, guys, be seeing you." The pilot opened the door and the rain burst into the room and ran wet fingers over his bowed figure. The door closed and he was gone.

There was silence as the Captain drew off his rough canvas dungarees.

"Did that new prop come for me yet?" he queried, at length.

"No, I haven't seen it. By the way, Captain, here's a young gentleman to see you. Name of Charles Montgomery. A reporter from his school newspaper. I wish *I* were famous enough to have the newspapers running after *me*."

Instrument board on modern transport

The Captain looked up, then flashed another of his smiles. He crossed over and grasped the youth's hand. "Gosh, it's darn nice of you to come to see me," he said.

The youth seemed a bit awed at the pleasantness of the greeting. "Yes, sir . . . thanks," he replied hesitantly. "May I speak with you a moment, sir?"

"Sure thing," the Captain drawled.

Wilkens rose, sliding the papers from his desk into a drawer. "Well, I'm going to get something to eat. You two make yourselves at home and talk all you wish."

The youth and the Captain were alone in the instrument-walled operations office. Outside, the rain was hammering on the window panes, accompanied by the harsh echoes of the storm.

"Well, Charles, what can I do for you?" Carroll inquired.

"It's . . . it's about your flight, sir. From Paris to California."

Carroll sagged lazily back into the traffic supervisor's swivel chair. "Oh yes," he murmured, "Well, you ask the questions and I'll see how many I can answer."

The youth drew a notebook from one of his numerous pockets, and sat with his pencil poised. "When do you leave Paris?" he asked.

"We don't take off from Paris, exactly. The flying field is at Le Bourget, about six miles away. We expect to hop off in exactly two weeks."

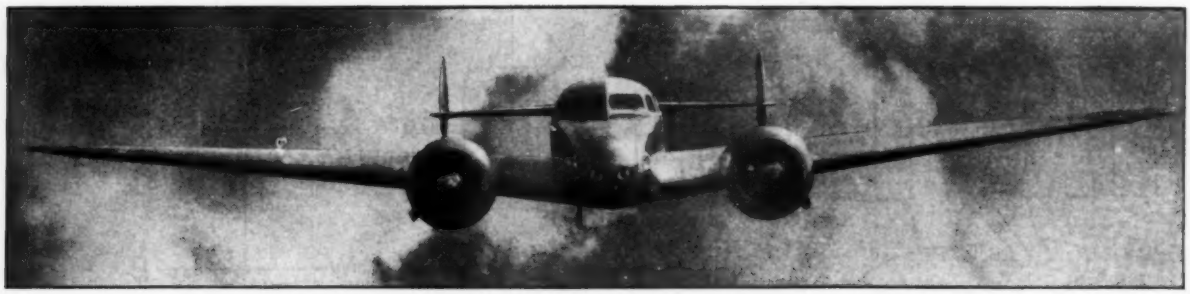
"Mr. Lanard and Mr. Kingsford are going with you, aren't they?"

"Yes. Sort of a partnership. We've known each other for a long time."

"How many times do you refuel on the trip?"

"Twice. Once in eastern United States and once in the west. Probably Denver in the west."

(Continued on page 32)



The Lockheed Electra in full flight. One of the fastest light transports in the world

On the Frontiers of Aviation

New Developments in Military, Transport and Commercial Airplanes That Give Promise of Great Improvement in American Aviation

By ROBERT C. MORRISON

THE year 1936 will be one of aviation's greatest years. Many outstanding planes that have been in the process of design for as long as four years will have undergone their final tests early this year. Much evidence was shown of this impending progress in my recent visit to several of the aircraft and engine manufacturers on the Pacific coast.

Lockheed has been very busy filling orders for their Electras. The company is producing the low-wing all-metal transports at the rate of one a week. The Army's numerous Altairs have recently been at the factory to undergo overhauling. Some have had new wings with flaps installed and all have been given a new paint job with the new regulation Army Air Corps colors of blue and yellow instead of olive drab and yellow as formerly. This will also be the color scheme of the new Northrop attacks. Most recent of orders for Electras came from Delta Airlines who ordered four. The Lockheed Aircraft Company is now bending all its efforts to the development of aircraft for feeder line work. Therefore the future Lockheed airplanes will be of the small variety and will have fast climbing ability which is desirable for feeder airline service.

The Aviation Development Corporation which builds the famous Vultee planes, located on Glendale's Grand Central Air Terminal in California, have completed their present large supply of orders for the Vultee V-1A. Activity had been so great that sheds had to be built outside of the factory to house the additional number of workmen needed to complete the planes on time. Now the company is working on five Vultees for private owners while waiting for the receipt of more orders from the air transport lines.

A series of the Vultee attack planes has been delivered to a South American government. Perhaps Vultee's next move will be towards the development of an attack plane for the U.S. government. However the company desires to keep secret all details of their military planes.

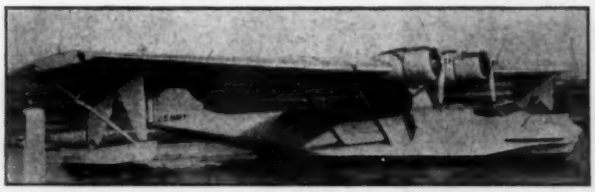
The Consolidated Aircraft Corp., is now working full force in their new giant factory at San Diego, Calif., to complete their present Army and Navy contracts as soon as possible. The factory is located on the famous Lindbergh Field next door to the Ryan Aeronautical Co. Across the bay can be seen the San Diego Naval Air Base, the home of the aircraft carrier "Ranger."

Ryan intends to enlarge their plant by one-third to make more room for the construction of their S-T sport plane. They have just completed a special model, a single-seater, using the space of the other cockpit for housing a large gas tank. The company has been working slowly, building the swift little planes only on order.

Howard Hughes, film producer and oil magnate as well as being holder of the world landplane speed record, is now located in a new building at the Union Air Terminal at Burbank, Calif. The wing of his record-breaking airplane has been redesigned for further speed attempts. There is much activity at the Hughes Company's factory, all of which is clothed in secrecy. Many engineers are hard at work there and it might be possible that Mr. Hughes may produce still another airplane.

At Northrop on Mines Field, Inglewood, Calif., much excitement prevails about their new Navy scout-bomber. As usual details of the plane are secretive, but its general details are now well known. It is similar to the Army attack planes now being built with twin-row engine and retractable landing gear. I had the opportunity of watching Vance Breeze, ace test pilot, test dive the speedy craft and was very much convinced of

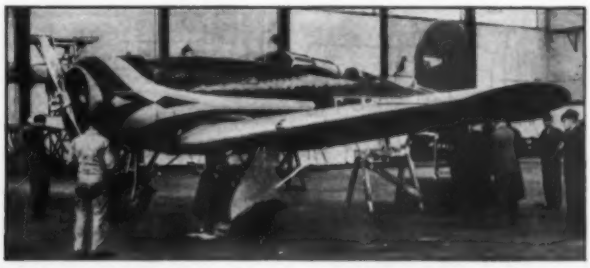
Here is one of the latest U.S. Navy Voughts. Note the tapered wings, a new feature for this type of ship



The latest Navy Patrol Plane, XP3Y-1 (See page 30)

The new Army Douglas Bomber XB-14 (Two 735 hp. engines)

The Luscombe Phantom with floats and powered with an 145 hp. Warner engine (Martin Photo)



Sir Kingsford-Smith's ill-fated plane being groomed for what proved to be its last flight

its capability. Among the numerous aircraft companies in the country, Northrop is unquestionably one of the most efficiently operated.

Douglas, the largest of the group, has had plenty of work to keep them moving right along. They have produced within a short period of time or are soon to complete approximately every type of airplane except that of a purely racing type. Among the list is the twin-engined DC-2 transport, twin-engined commercial and sport amphibian, twin-engined Army Senior amphibian, land scout-bomber, scout amphibian, Navy patrol flying boat, Army twin-engined bomber, twin-engined sleeper plane, observation monoplane and biplane, and they are now said to be working on a Navy dive-bomber, pursuit plane, four-engined transport, torpedo plane and perhaps some others.

Among their recent orders were the Army Air Corps contracts for eighteen DC-2s and spare parts, total value—$1,235,000!

Two months ago Albert Plesman, P. Guilonard, and H. Veenendaal, high officials of the Royal Dutch Airlines (K.L.M.), landed in this country in quest of new equipment. The airline, which now operates Douglas DC-2s, has had so much business that more equipment is needed. The result—news comes that fifteen more Douglases have been ordered for the line!

The first of Douglas' new 2,000 hp. airliners has been completed. This ship was briefly described in previous issues of this paper. Additional information follows:

Wingspread—95′
Length overall—65′
Height overall—17′ 6″
Capacity (day)—24 passengers
Capacity (sleeper)—16 passengers

The giant craft will have the same general lines as the DC-2 but will be 2½ tons heavier. The cabin consists of eight roomy sections, four on each side of a broad aisle. As a sleeper, each section contains two seats 35 inches wide facing each other. These seats may be folded to form a lower birth. The upper berth, with mattress, will be dropped from the ceiling. Berths will be 6 feet five inches in length, lowers 35 inches in width, uppers 29 inches in width. The giant Douglas is able to fly on one engine with full load. American Airlines has placed an order for ten of these planes.

1000 Russian Air Infantry descend via parachute behind the "enemy" lines. This new system of attack may revolutionize military tactics

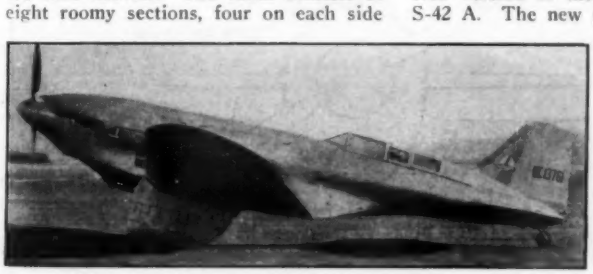
Sikorsky has recently completed their 1935 version of the S-42, known as the S-42 A. The new plane has a 118 foot 2 inch wingspread and has a top speed at 7000 feet of 190 m.p.h. Other performance data follows:

High speed at sea level	180 m.p.h.
Gross weight	40,000 lb.
Cruising speed at 12,000 feet	170 m.p.h.
High speed, three engines	155 m.p.h.
Cruising speed, three engines	135 m.p.h.
Landing speed, 26,000 lb. load	65 m.p.h.
Initial climb, four engines	800 f.p.m.
Initial climb, three engines	300 f.p.m.
Service ceiling, four engines	16,000 ft.
Service ceiling, three engines	7,500 ft.
Range at cruising speed	1,200-3,000 miles according to number of passengers carried.

With a cruising range of 1,200 miles the plane may carry a crew of five and 32 passengers, but if it is put into Pacific service the range will be increased and the passenger capacity therefore decreased. A 1,000 pound payload may be carried with a range of 3,000 miles. British Aircraft Ltd. of Manchester, England, has made a $500,000 deal with Sikorsky Aircraft to manufacture their S-42s in England. The deal only concerns the original S-42 design and not the S-42-A which will continue to be built in this country together with many other new Sikorsky ships.

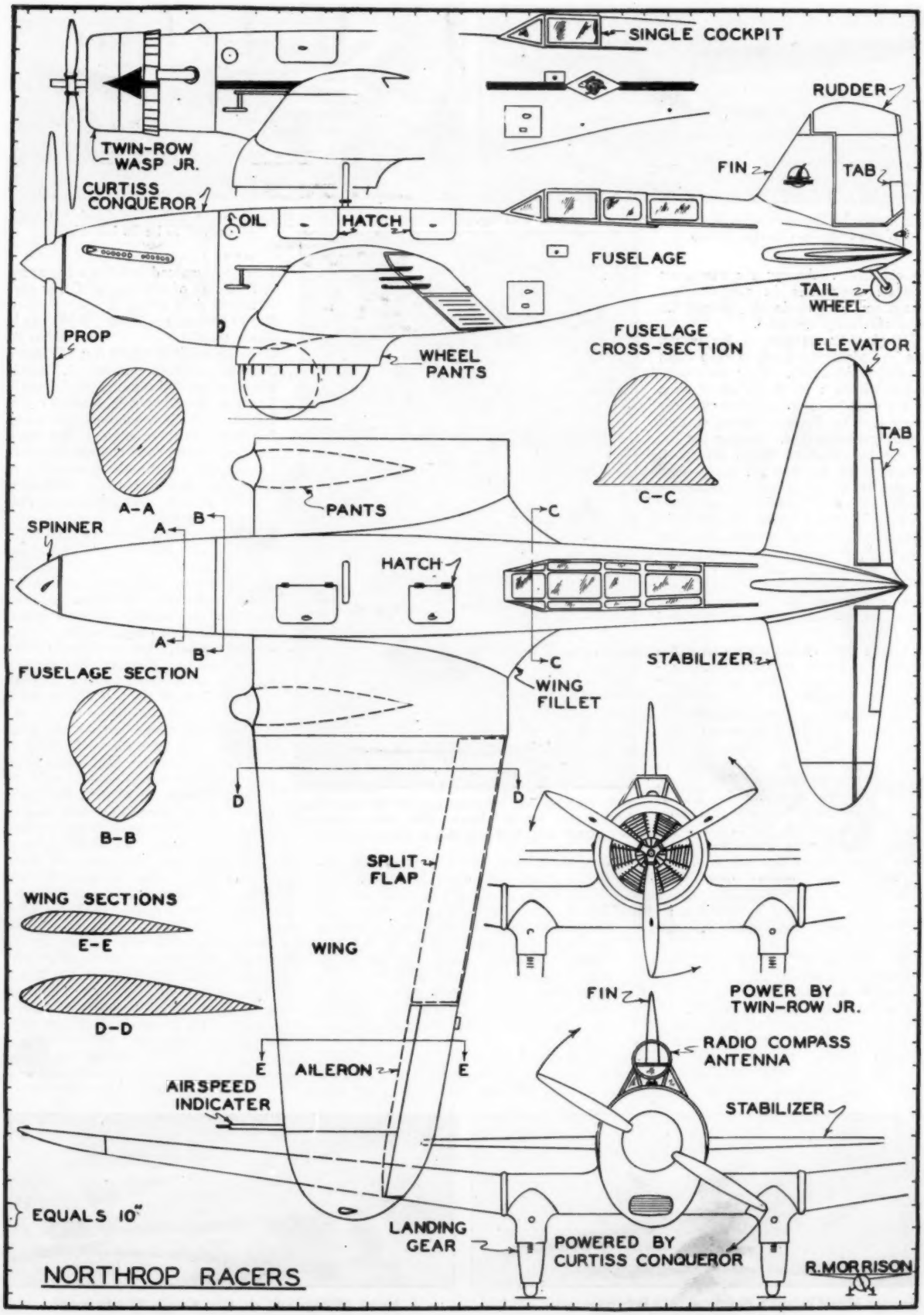
Soon private fliers will be flying planes much resembling that famous Bendix and Thompson Race winner, "Mister Mulligan," as Benny Howard has announced the completion of plans for such a ship. The famous pilot and designer has been considering entering the commercial airplane field for some time. His final decision as to whether he would undertake the project or not depended on "Mister Mulligan's" performance at the 1935 National Air Races. Its success was so great that it did not take Benny long to decide to complete the plans of his proposed plane and begin construction. The ship will be a four-place sport plane having the same general lines as his racer. It will cruise at

(Continued on page 40)



Miss Cochran's Northrop, MacRobertson entry

Latest "Fool-proof" airplane, Curtiss-Wright coupe


SINGLE COCKPIT
RUDDER
TWIN-ROW WASP JR.
CURTISS CONQUEROR
FIN
TAB
OIL
HATCH
FUSELAGE
TAIL WHEEL
PROP
WHEEL PANTS
FUSELAGE CROSS-SECTION
ELEVATOR
TAB
A-A
PANTS
C-C
SPINNER
A
B
C
HATCH
STABILIZER
FUSELAGE SECTION
WING FILLET
D
D
B-B
SPLIT FLAP
WING SECTIONS
E-E
WING
POWER BY TWIN-ROW JR.
FIN
D-D
RADIO COMPASS ANTENNA
E
AILERON
E
AIRSPEED INDICATER
STABILIZER
EQUALS 10"
LANDING GEAR
POWERED BY CURTISS CONQUEROR
R.MORRISON
NORTHROP RACERS

How to Design Your Model Planes

Chapter No. 5

How Aerodynamic Forces and Their Arrangement Act As a Basis of Design and Determine Model Plane Performance

Article No. 47

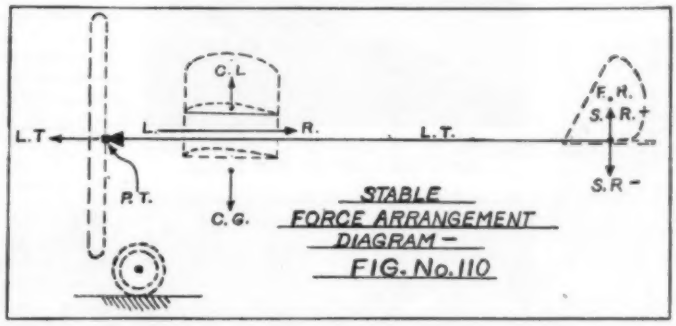
By

CHARLES HAMPSON GRANT

IN ORDER to create a model that will perform exceptionally well in some respect, such as duration of flight, it is necessary that the builder has a clear conception of the difference between model building and model designing.

Most model fans are model builders and not designers. When they proceed to create a new model, they visualize mentally the physical form of the plane, the wings, body, tail and other parts, the proportions of which individually and as a unit are prompted by ideas gained from experience in building and flying planes. In order to create a fine ship they must follow the "cut and try" method and spend many hours of guessing what the proportions of the plane should be in order to have it perform in the desired manner.

The true designer goes about his joyous task in another way. He realizes that the shape and proportions of the model structure is merely the medium through which the aerodynamic laws of flight operate to give a particular type of performance. By creating a model from a mental picture of the structure, the builder assumes that such a structure will perform as desired. The designer realizes that the structural shape is important only as a means through which a predetermined arrangement of aerodynamic forces may operate to accomplish a desired result. The aerodynamic arrangement of forces that act on and within a model when it is in flight, is the important thing.



The designer visualizes the *proper arrangement of forces* first of all, *not the structure*. If, after careful consideration, he finds that a particular arrangement will produce the type of performance he wishes, then it is his next task to design the structure in such shape and form that will embody this particular arrangement and act in the manner planned for it when it is in flight.

Thus to *design* a model airplane that will give a creditable performance requires mental tools, not physical ones. These mental tools are the complete understanding of the mathematical and scientific laws that govern the flight of a model plane. Without such knowledge one must confine his activities in this field to those of a builder, not a designer. The preceding articles of this series have provided the mental tools, the exposition of the scientific laws that influence the model's flight performance. It is hoped that you have taken these "tools" unto yourself and now have them ready to use and accomplish the interesting task of designing successful fliers.

Thus there remains only one more qualification that a designer of model aircraft should possess. He should now learn how to *use* these "mental tools," the laws of design. This chapter tells you how to do this. It explains the procedure of design; how to use the laws of model design to secure any type of performance you may desire in a model airplane.

The model flier that is consistently most successful in placing among the winners in contests is the one who sits down at his planning board and applies his knowledge of design to a carefully drawn plan of his dream ship. He does not proceed to design "just any" airplane. Usually he has some definite *purpose* that he wishes his model to accomplish. What this purpose is determines how the model is to be proportioned. The most common event in contests held at the present time is *"duration."* However, models may be designed for many other purposes, such as distance, speed, fast climb, altitude and stunting. There are also modifications of these qualities. A model may be desired for duration hand-launched, R.O.G. (rise off the ground) or R.O.W. (rise off the water). Each one of these types of performance requires that the model have certain flight characteristics which in turn depends upon the arrangement, relative proportions and shape of the aerodynamic and physical characteristics of the model in accordance with the laws of flight.

So we may say that the correct procedure to follow in designing your model is to consider; first, the *purpose* for which it is intended; second, the arrangement and size of the aerodynamic characteristics that will provide stability and fulfill the purpose; third, the *type* of *airplane* that you believe will provide these aerodynamic characteristics in the most complete and convenient manner; fourth, the size of the plane that you believe will suit the purpose and structural demands; fifth, the arrangement and size of the physical characteristics that will fulfill the requirements of type, size and aerodynamic factor arrangement; and sixth, the shape or external form of the plane and its parts.

In order that a model gives a certain type of performance, like speed or duration, to a high degree it must be efficient aerodynamically. That is, it must generate as *much* lift and as *little* drag or resistance as possible. The flight capacity of a model is proportional to this ratio; i. e., lift divided by the drag, or $\frac{L}{D}$. However, a model may embody great flight capacity but may not be able to make use of it because it is not stable. Its lack of stability may destroy its efficiency completely or cause the plane to crash to earth prematurely.

In such a case, efficiency is useless. In other words, in order that a model may demonstrate its efficiency, it must be stable enough to remain in flight until the power is expended and it comes to earth after a normal descent from its maximum altitude. *Stability*, therefore, is the most important quality that an airplane can possess and should be the first consideration in designing.

There is no need of overstabilizing a model, however, for stability is often obtained only at the expense of efficiency. Many of the arrangements that produce stability often cause a loss of flight efficiency, the dihedral angle of the wings, for instance. When the tips of the wings are turned upward to form a "dihedral," the air spills out of the wing tips to a certain degree, causing a small loss in lift. The greater the angle is, the less the lift on the wings will be. Therefore, the proper amount of dihedral to use is that amount which produces *sufficient* stability, but not an excessive amount. Thus the loss in efficiency is kept down to a minimum. Herein lies the art of model airplane building; assigning the proportions of a plane that will cause it to be stable yet as efficient as possible.

Beginners cannot expect to design a plane that will equal in performance that of an expert. As in every other walk of life, experience is required to produce perfection.

Insomuch as stability is the paramount factor in model plane design, let us follow through the complete procedure of designing a model plane with this as our only purpose. This model will not be designed for any specific type of performance, but merely for *stability*, allowing for as much flight efficiency as possible without sacrificing this quality. No definite numerical values will be assigned to the factors entering into the design of this plane at present. Only the order in which

(Continued on page 36)

Pict. No. 1. A beautiful fully-equipped scale model of "Mister" Mulligan by Dick Bell. No detail is lacking

AIR WAYS

HERE AND THERE

What Readers Are Doing to Increase Their Knowledge of Aviation in All Parts of the World. Send Pictures and Details of Your Experiments

IT IS sad to relate that the gas model builders have deserted our Air Ways column. In fairness to them let us say that it is not due to any highmindedness on their part. You will have to blame your editor for this. Now they have a department of their own, under the facetious heading of "Gas Lines." This procedure was taken because of the fact that gas model building is becoming a distinct activity in itself and gas models cannot always be compared with the rubber-powered variety. If you are a gas model fan, do not fail to read "Gas Lines" on page 7.

Our best picture this month has been sent in by Dick Bell of 19 Allen Street, Johnson City, New York; picture No. 1 of his "Mister" Mulligan. It is an unusually fine job and has all the equipment of the real ship in detail. This is a big order but apparently is true.

Another remarkable model is shown in picture No. 2. It is a twelve inch solid scale Ford Trimotor, built by Henry Clark of 46 Fort Washington Avenue, New York City. He says:

"The small size of this model limits the amount of detail that can be put into it. It is very plain in construction but has a brilliant finish." Clark is very modest. Close examination of the picture will reveal that even though the model is of a diminutive size the detail is excellent. In our opinion Clark deserves a lot of credit for this piece of work.

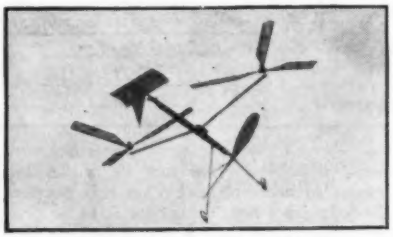
Next we have something very unusual and interesting in the form of a ground trainer, built by Neal Loving of 2328 Eighteenth Street, Detroit, Michigan. It is shown in picture No. 3. Loving says:

"It was part of the Junior Birdmen exhibit at the recent Air Show held at Detroit City Airport. It has a span of twelve feet and weighs about sixty-five pounds. It has supported 190 pounds in the cockpit without damage. The engine was converted from an air compressor and turns a forty-two inch prop. It has never been tested but I believe it capable of short flights. Although it has a plywood fuselage and regular fabric-covered wings, the total cost amounted to only thirteen dollars."

Mr. Loving will be glad to answer any questions concerning this trainer, providing a self-addressed envelope is enclosed with the letter to him.

Sometime ago plans for a twin autogiro were published in MODEL AIRPLANE NEWS.

Pict. No. 3. A clever 12 ft. ground trainer with a real motor by Neal Loving



Pict. No. 4. Murray Fitz-Gerald likes experimental models. Here is a twin autogiro he built and flew successfully

Picture No. 4 shows an excellent model built from these plans by Murray H. Fitz-Gerald of 126½ Celar Street, Halifax, Nova Scotia, Canada. Fitz-Gerald says that he takes great pleasure in building unusual models and he found that the twin autogiro came under this classification. He continues:

"It provided me with many a headache and nearly heart failure many times. As soon as I would launch it, it would do a complete roll and descend vertically. I 'ironed' this out by increasing the negative incidence on the rotor that fell."

Alex Phimister writes us from 1101 Dominion Street, Winnipeg, Manitoba, Canada. He enclosed one of his latest models, a Boeing P12-E, which is shown in picture No. 5. It is a very fine-looking job, to say the least. The wings, tail assembly, struts, etc., are solid balsa. The fuselage is built up in the regular way of $\frac{1}{16}$" wood doweling, covered with balsa slabs. The motor is built of cork. The control system all works from the cockpit, which is fully equipped with fire extinguisher, throttle, etc. Mr. Phimister is a member of the Model Aircraft League of Canada and was fortunate enough to take second place in the Canadian National Contest with one of his earlier models, a Boeing P12-B scale model.

MODEL NEWS FROM OTHER COUNTRIES

England

We have word from C. S. Rushbrooke of 14 Ennerdale Drive, Ashton on Mersey, Sale, Cheshire, England, who is Honorable Secretary of the Lancashire Model Aircraft Society. As many model builders know, Mr. Rushbrooke is a consistent entry in the Moffatt Trophy Event of the National Competitions. He is the young man who lost his model after an eight and a half minute flight during the Wakefield elimination trials in 1935 and thus lost to Gordon S. Light of America. He has been kind enough to send picture No. 6 of one of his racing jobs.

Model builders would do well to study the construction of this model carefully. It is one of the finest pieces of work we have seen and the design of the structure shows a clear conception of the stresses involved in model flying and how they act on the model. The long diagonal braces in the fuselage to the rear of the wing are very clever. They brace the fuselage satisfactorily yet require little material. On the whole it is an exhibition of exceedingly fine workmanship.

We are sure that Mr. Rushbrooke would

Pict. No. 5. A detail scale Boeing P12-E with which Alex Phimister is winning contests in Canada

Pict. No. 2. Though only 12 inches in span, no crude workmanship shows on this model of a Ford Trimotor by Henry Clark

Pict. No. 7. Members of Escadre de la Rose des Vents at a contest in France. Mrs. Weber adjusts a Macchi-Castoldi

Pict. No. 10. Pres. Masaryk watches Arnost Klein prepare a model for flight at a contest in Czechoslovakia

be pleased to hear from any young American boys, as he is an ardent rooter for co-operation between the two countries.

France

In the last two years, France has become exceedingly active in model aeronautics. One of the most active clubs is the Escadre de la Rose des Vents of 2 Boulevard des Filles du Calvaire, Paris, 11°, France. Mr. J. Mahn is the second secretary. He writes and tells us that at Le Havre during the past summer, the club won the majority of the prizes, nearly all first place. Four of the members flew for over two minutes and ten for over one minute. In the glider competition, the club won everything. Mr. Mahn says:

"All of our competitions are for fuselage outdoor models, rather than for the stick type."

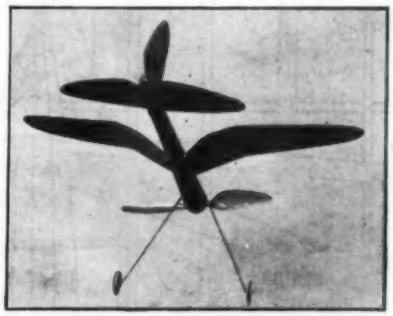
At a contest on September 1st at La Banne d'Ordanche (Puy de Dome) they won the Republic President's Cup, even though the wind was blowing at the rate of one hundred feet per minute which is approximately 75 miles per hour.

In picture No. 7, Mr. Mahn, second from the left, is shown with other members of the club busy with the models which they entered. Mr. Weber is president. He is second from the right. Mrs. Weber is shown putting the finishing touches to a beautifully-built Macchi-Castoldi. We are interested to know whether or not this ship was built from Mr. Bristol's plans appearing in MODEL AIRPLANE NEWS. Other models that are shown are the Bernard Racer and Caudron.

Mr. E. Jarland of the Ligue Aeronautique de France of 18, Avenue Victor-Emanuel III, Paris, 8°, France, writes and asks us if we will not have American model builders write to him in regard to what they are doing in this country. I am sure some helpful ideas can be obtained by both American and French model builders by this procedure.

We hear from Pierre Legros of the Modele Air Club de France, 47 Rue des Courvelles, Paris, France. The club just organized its first show of small models in France with the co-operation of the R.A.A. and with the help of the French newspaper, "Intransigent". This exhibition opened October 6th and showed the development of models in France. The club was publicly congratulated by M. Demain for its efforts and for the services it has done in making France air-minded.

On Sunday, October 13th, M. Guillemard won the prize in the first competition for small hydro airplane models, under the auspices of the Ligue Aeronautique, at



Pict. No. 9. A model which has been put into mass production in Russia

Pict. No. 11. Model builders of the Lincoln High Solo Club who are now flying. Back row, left to right: Jack Reed, Joe Kleymeyer, Bob Geren. Front row, left to right: Louis Place, Jimmy Funk, Bud Johnson, Franklin Lane

Chatou on the Seine. The model remained in the air for 41½ seconds.

Mr. Legros tells us that they have several Brown motors, all of which are operating successfully.

Russia

Picture No. 9 shows an unusual Russian model which is now being made in mass production. The wings are of welded steel wire covered with silk. The fuselage is of monocoque construction and probably of wood; the propeller is made of dural and the pitch can be varied at will. The design is exceedingly clean and it performs well.

Following is some of the first authentic information which has come from Russia concerning model activities.

In the Soviet Union there is a mass organization of model airplane builders, "The Young Aircraft Builders," who hold a contest annually for their models. In 1935 the contest was held at Moscow during the summer and ended with a few world's records being claimed by these model builders. The organization recognizes records made by three groups. The first group is made up of children under twelve years of age. The next group is made up of those between twelve and sixteen, which is the age limit. Girls compose the next group. There were 328 models at this year's contest. Of these, 45 (13.7%) were stick models, and 100 (30.5%) were gliders. In past years stick models usually made up about 50%; so in this respect an improvement was shown.

In the Soviet there is not much activity in gas-powered models but from now on the Young Aircraft Builders will work steadily to achieve a high order of technique in miniature gas engine powered model design.

World's records now claimed by the sixteen year old group are:

Stick model-Tractor type-hand launched, 4 hrs. 23 min.

Stick model-Canard type-hand launched, 1 hr. 55 min.

Stick model-R.O.W., 3 min.

Fuselage model-R.O.G., 9 min. 48 sec.

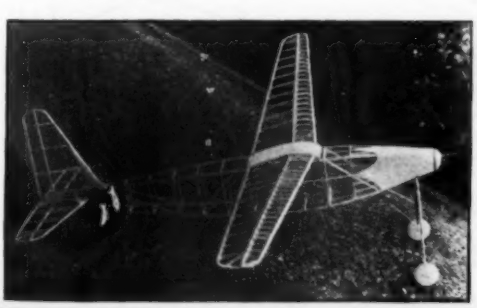
Fuselage model-R.O.W., 1 min. 26 sec.

Glider (fuselage) hand launched, 1 hr. 0 min. 5 sec.

Glider (tailless) dropped from kite, 15 min. 10 sec.

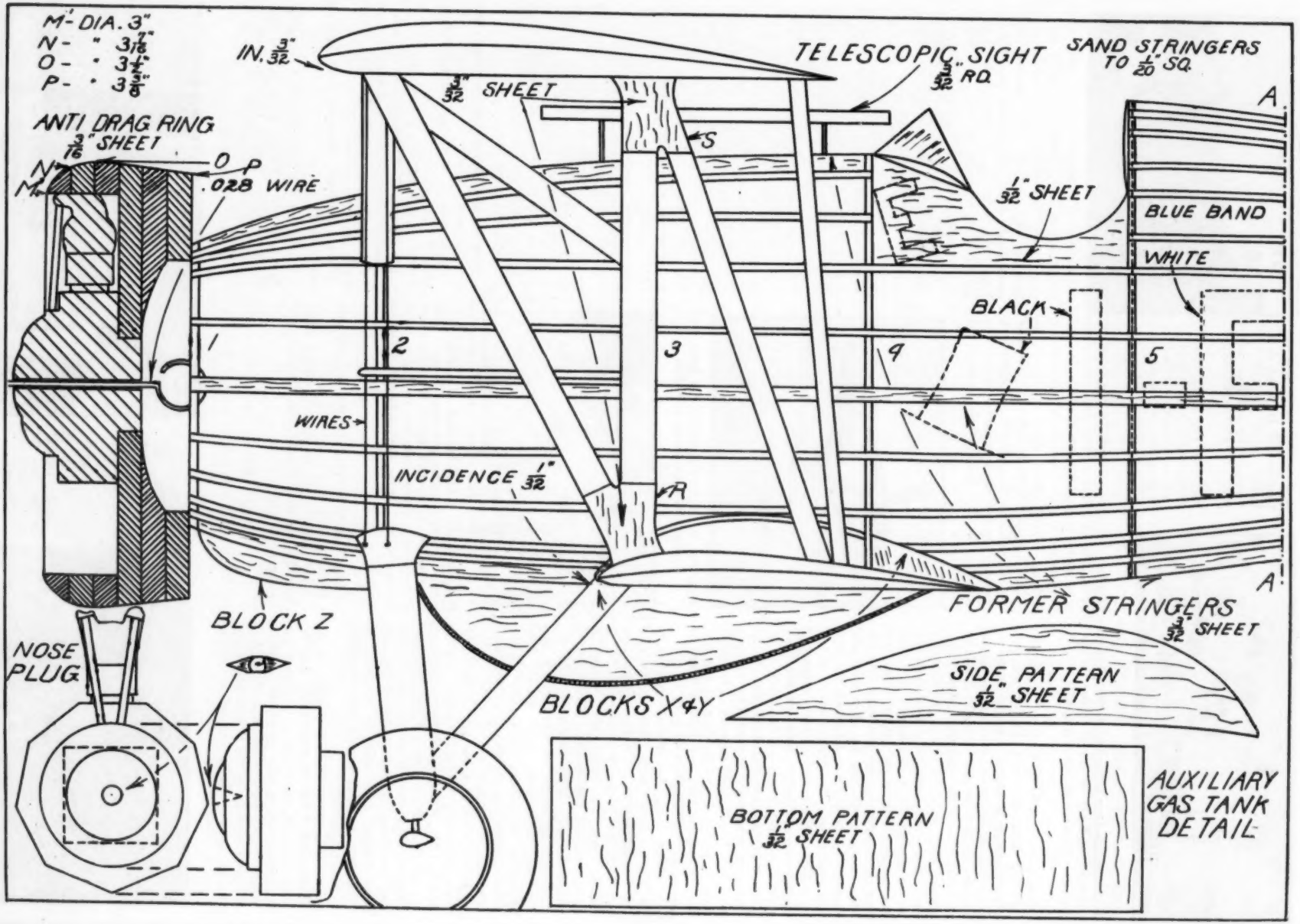
Present at the meet were five autogiros, two helicopters, twenty-eight tailless gliders, three rocket models, two dirigibles and twenty other unclassified experimental

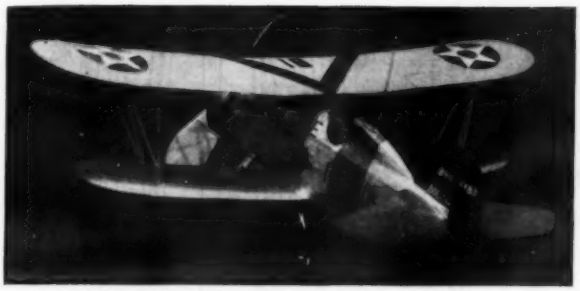
(Continued on page 42)



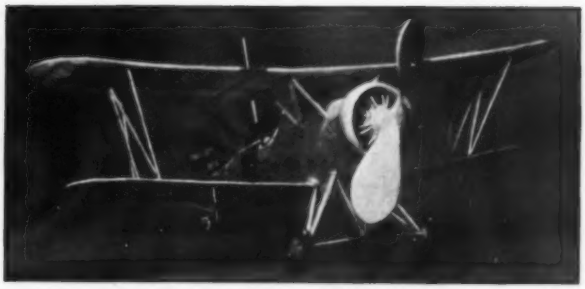
Pict. No. 6. A beautiful piece of contest model construction by C. S. Rushbrooke

Pict. No. 8. A "small model" exhibit of the Aero Club of France


M- DIA. 3"
N- " 3 7/16"
O- " 3 1/4"
P- " 3 5/8"
IN. 3/32
TELESCOPIC SIGHT
3/32 RQ.
SAND STRINGERS TO 1/20 SQ.
3/32" SHEET
ANTI DRAG RING
3/16" SHEET
N
M
O P
.028 WIRE
S
A
1/32" SHEET
BLUE BAND
WHITE
BLACK
1
2
3
4
5
WIRES
INCIDENCE 1/32"
R
BLOCK Z
NOSE PLUG
C
BLOCKS X & Y
FORMER STRINGERS
3/32" SHEET
SIDE PATTERN
1/32" SHEET
BOTTOM PATTERN
1/32" SHEET
AUXILIARY GAS TANK DETAIL



Attention to detail creates a fine appearance



This ship will be a credit to your fleet

Build and Fly This Boeing Fighter

How You Can Construct a Flying Miniature of One of Uncle Sam's Greatest Navy Fighters

By WILLIAM WINTER

THE Boeing F4B-4 fighter needs no introduction as it is probably the most popular service ship of the day. Its every line suggests the ruggedness for which it is famous. It is noted in the air for the ease with which it withstands the most violent maneuver. The well known Pratt and Whitney "Wasp" rated at 420-550 hp. reliably meets all the demands of pursuit tactics.

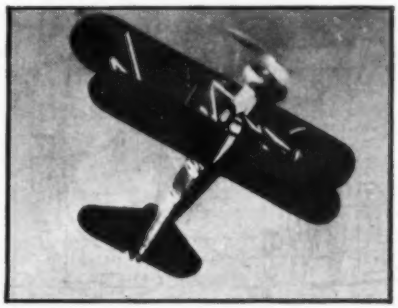
The model like the real ship is synonymous with stamina. Despite the fact that pursuit ships usually make mediocre models, the F4B-4 is an excellent performer. It possesses stability to an unusual degree and will afford many hours of sure-fire flights with little or no repairs.

Fuselage

Cut all the bulkheads from 1/16" sheet balsa. Using the patterns given, cut the former stringers from 3/32" sheet. Cement the two side former stringers in place on all the bulkheads. When dry, attach the top and bottom stringers. The auxiliary stringers are 1/16" sq. sanded to about 1/20" sq. They are placed in the proper notches and cemented. The rudder post is cut from a piece of ¼"x 3/16" and glued in position. The rear hook is bent to shape from .028 music wire and sunk in the rudder post as required. The cockpit is formed by bending 1/32" sheet. The sheet is first cut to the necessary width and length. The lower edge is cemented to the stringer below the cockpit. When dry, the sheet balsa is bent the remaining distance and glued. The cockpit outline is marked with a pencil and cut out with a sliver of a razor blade. A small piece of 1/16" sheet, the pattern of which is given on the bulkhead sheet, is inserted between the extensions of No. 3 and 4 bulkheads and forms the center portion of the fillet.

To cover, use narrow strips of the best grade paper obtainable. Each strip runs the entire portion of the fuselage. The headrest also is covered with numerous narrow strips to avoid wrinkles. The finished covering is lightly sprayed and doped.

Cut fillet blocks X (7/16"x1-1/16"x 7/16") and Y (1-1/16"x1"x1-1/16"). Block X is cemented flush with the front face of No. 3 bulkhead. Block Y is attached in the same manner to the rear face of No. 4 bulkhead. If any care is exercised in the carving of these fillet blocks, no trouble will be had in their attachment.



The model is an excellent flier. The large stabilizer aids performance

The auxiliary gas tank adds very little weight but much in appearance. The side patterns are cut from 1/32" sheet and cemented to the bottom of the fuselage at the required position. The lower covering or bottom of the tank is also 1/32" sheet. It is bent to shape as it is glued in place. Cement one end and allow to dry. Bend a bit further and allow to dry again. In this manner there can be no cracking. Block Z is cut from a soft block 1⅜"x1-3/16"x7/16" and is attached at the position shown in the side view.

The entire fuselage unit, if painting is desired, should be silvered. The markings are easily discerned in the pictures. Though the painting adds weight, the F4B-4 will fly well.

The windshield is celluloid. Directly in front of the windshield at the position noted on the side view, the telescopic sight is located. A strip of 3/32" is cut to the required length and rounded. The sight is painted black.

Landing Gear and Tail Wheel Assembly

The main landing gear strut is cut from ⅛"x⅜" stock and streamlined. The small fillets shown are made from ¼" sheet and attached with bamboo pins and cement. Do not dispense with the pins as they are necessary. The main struts are attached to the fuselage as required. It would be use to cut away a tiny opening in the paper so that the strut will have a firm contact with the wood of the bulkhead. The rear struts, the spreader bar and the struts marked M are all cut to the required lengths and streamlined from hard ⅛"x ¼". The spreader bar is attached to the bamboo pins at the lower extremities of the main struts. There should be a small clearance between the wood of the bar and the main strut. The 1⅞" wheels are mounted on .028 music wire axles. The axles are attached to the spreader bar in such a manner that their ends sink into the wood at a point just below the attachment of the M struts. The axles are bound with thread and cemented.

The ½" tail wheel is mounted on an .014 wire axle. The wood mount seen on the side view is a piece of 3/32" sheet attached to the cut away portion of the rudder post.

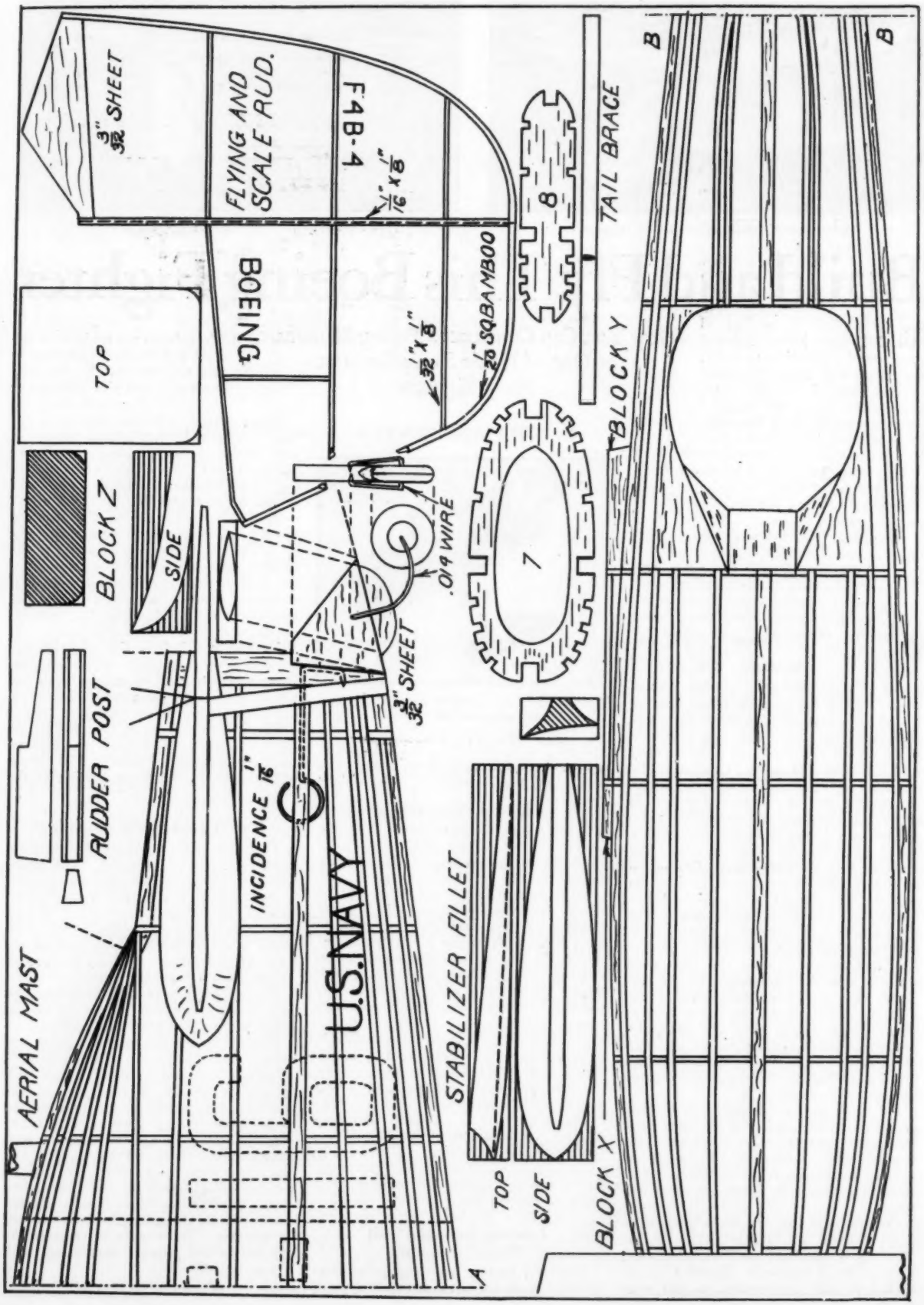
Tail Assembly and Mounting

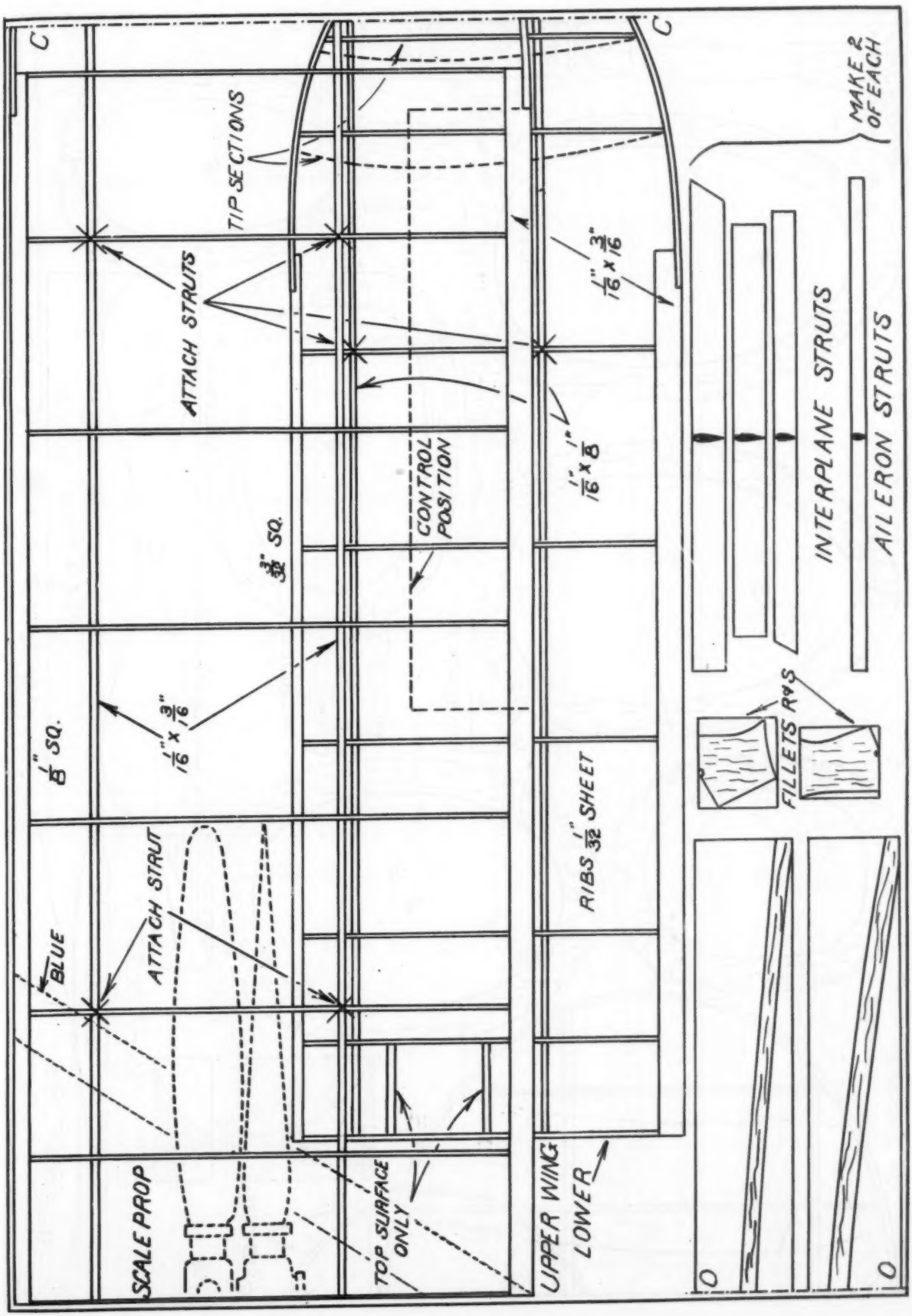
The main spars are 1/16"x⅛" and are pinned directly to the bench. The cross-pieces are cut to the required lengths from 1/32"x⅛" and are cemented in place. The lowest cross-piece of the rudder is cut from 3/32" sheet. The edges of both stabilizer and rudder are formed by bending 1/20" sq. bamboo to shape around a candle flame.

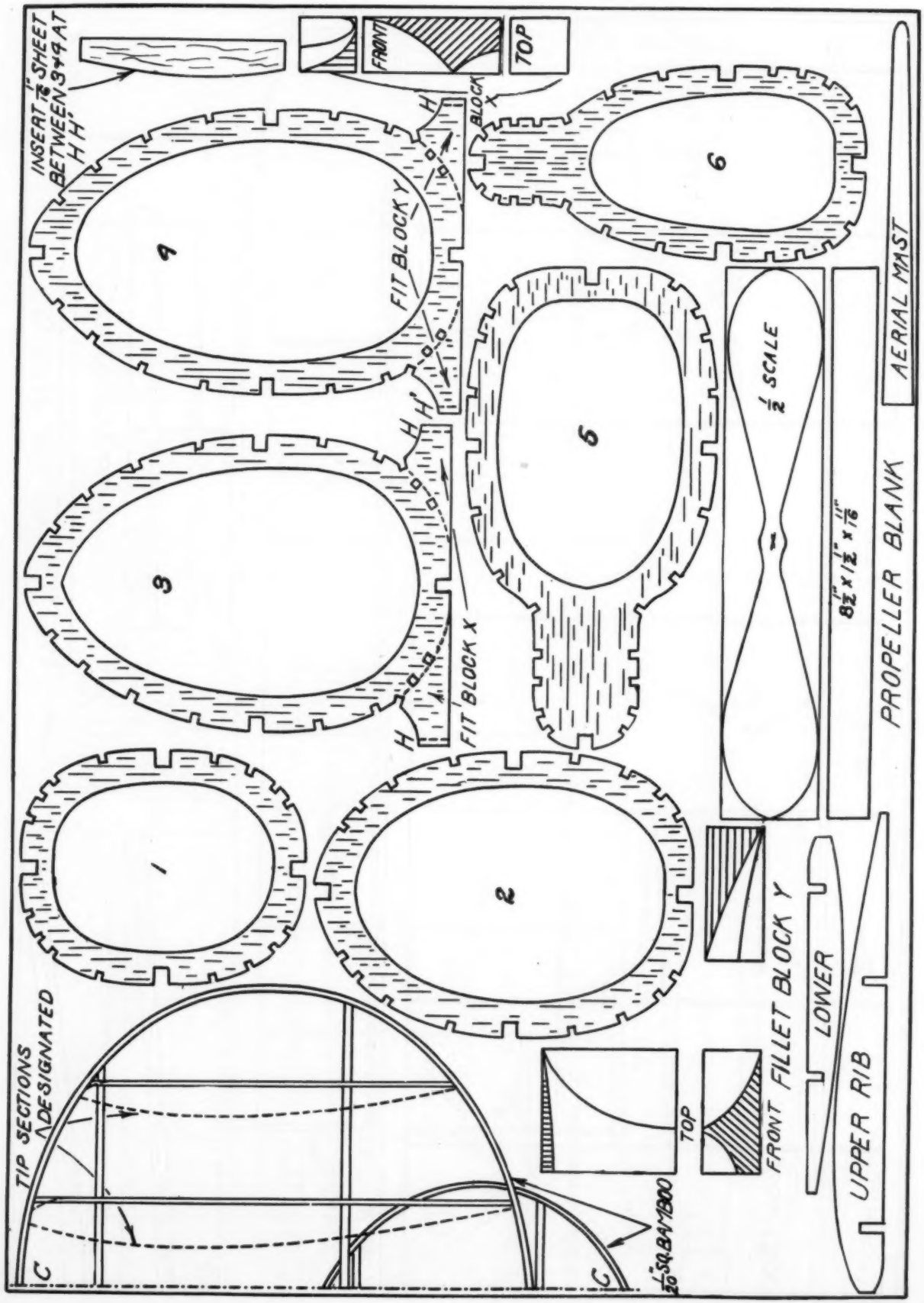
Cover each side of both stabilizer and rudder with separate pieces of tissue. Dope the finished surfaces lightly.

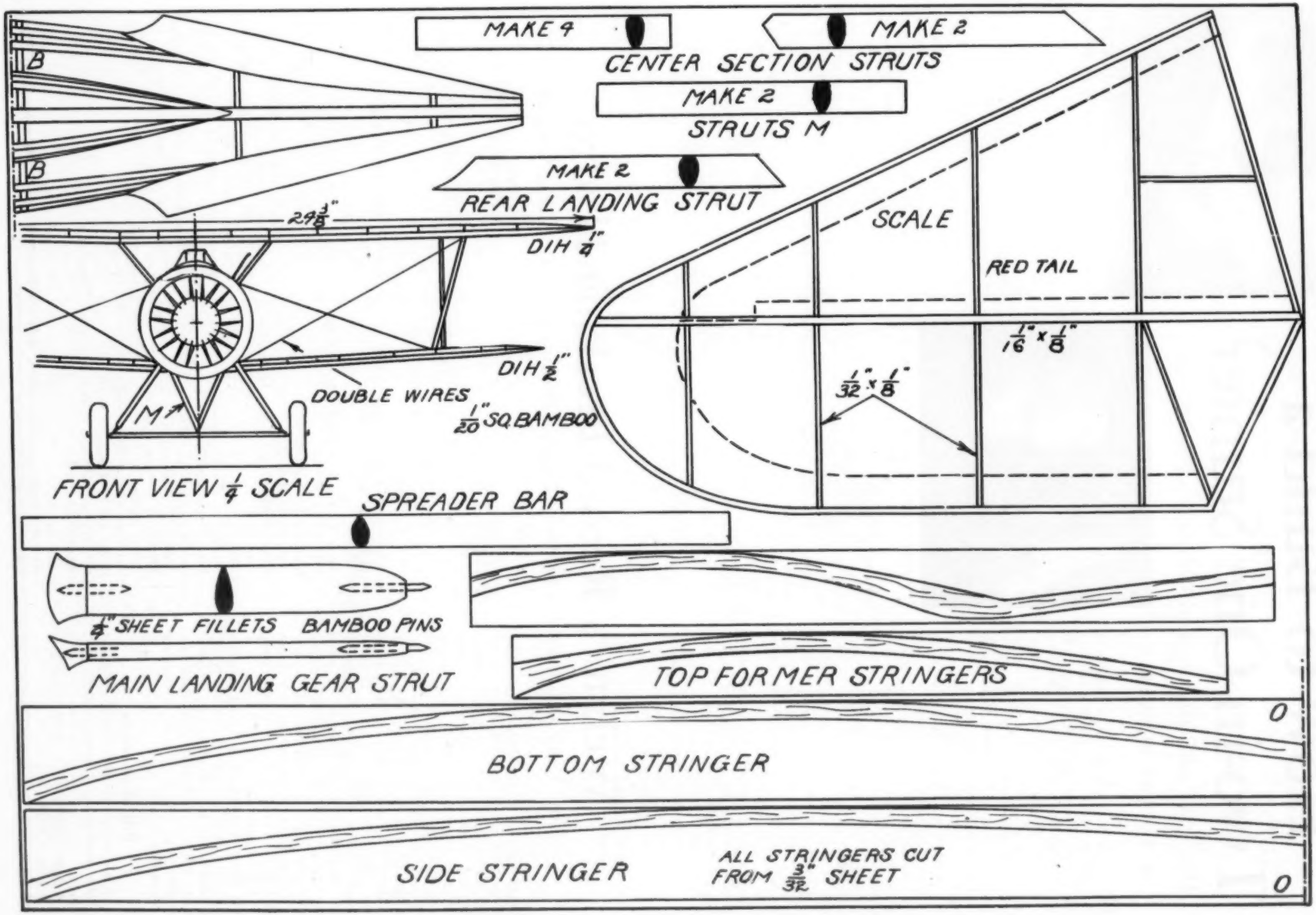
The fillets are cut to shape as shown from two blocks 3-1/16"x⅝"x5/16". They are attached to the fuselage with very thick cement. If necessary, expose a quantity of cement to the air until the desired consistency is attained. If any crevices result from a variation of construction, carefully fill them with this thickened cement as they are to be painted over. Attach the stabilizer halves to the fillets with cement. The tail braces are cut to the given lengths and cemented in position. The rudder is cemented to the top former stringer and braced with black thread.

(Continued on page 38)


3/32" SHEET
FLYING AND SCALE RUD.
F4B-4
1/16 x 1/8"
BOEING
TOP
1/32 x 1/8"
.25 SQ BAMBOO
8
TAIL BRACE
B
B
BLOCK Y
BLOCK Z
SIDE
.019 WIRE
7
RUDDER POST
3/32" SHEET
INCIDENCE 1/16"
U.S.NAVY
AERIAL MAST
STABILIZER FILLET
TOP
SIDE
BLOCK X
A


C
C
TIP SECTIONS
ATTACH STRUTS
1/16" x 3/16"
3/8" SQ.
CONTROL POSITION
1/16" x 1/8"
1/16" x 3/16"
1/8" SQ.
BLUE
ATTACH STRUT
SCALE PROP
TOP SURFACE ONLY
RIBS 1/32" SHEET
UPPER WING
LOWER
MAKE 2 OF EACH
INTERPLANE STRUTS
AILERON STRUTS
FILLETS
RODS


INSERT 1/16" SHEET BETWEEN 3 & 4 AT H H'
FRONT
TOP
BLOCK X
FIT BLOCK Y
FIT BLOCK X
H
H'
1
2
3
4
5
6
1/2 SCALE
8 1/2" x 1 1/2" x 1/16"
AERIAL MAST
PROPELLER BLANK
LOWER
UPPER RIB
FRONT FILLET BLOCK Y
TOP
TIP SECTIONS DESIGNATED
C
C
1/16 SQ. BAY 1800


MAKE 4
MAKE 2
CENTER SECTION STRUTS
MAKE 2
STRUTS M
MAKE 2
REAR LANDING STRUT
B
B
29 3/8"
DIH 1/4"
DIH 1/2"
DOUBLE WIRES
1/20" SQ. BAMBOO
M
FRONT VIEW 1/4 SCALE
SCALE
RED TAIL
1/16" x 1/8"
1/32" x 1/8"
SPREADER BAR
1/4" SHEET FILLETS
BAMBOO PINS
MAIN LANDING GEAR STRUT
TOP FORMER STRINGERS
BOTTOM STRINGER
SIDE STRINGER
ALL STRINGERS CUT FROM 3/32" SHEET

How to Build a Two-in-One Stunter

Here Is a Real Performer, Easily Made in a Few Minutes

By AUGUST RUGGERI

HERE is a new idea for a two-in-one combination model. A model that is an R.O.G. speedy stunt plane when flown with the propeller and a stunt glider when flown without the propeller and rubber. Another unusual feature is the fact that it can be built in a few minutes. You will find it simple to build and an unusual performer.

As an R.O.G., it will rise off the ground under its own power, climb fast and high and make several loops. It can be made to fly either straight or in circles.

As a stunt glider, it will make inside and upside down loops, it will spiral up and down, and if thrown at an angle, *it will circle and come back to you.* Here is a little ship you can build and fly successfully if you have never built one before.

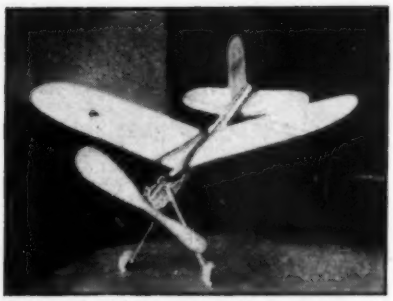
The materials needed are few in number. For tools all you need is a razor having one cutting edge, a pair of pliers and a piece of sandpaper.

The wing is cut from medium balsa slightly thicker than 1/32 inch. Cut two pieces 2" wide and 5" long. Leave one end of each piece flat and round off the other into the shape shown in the plans. When this is done, you simply sandpaper each piece so that an airfoil section as shown in the diagram is formed.

The author ready to launch the plane as a glider

They are then cemented in the center, being sure to make a perfect joint and to make the dihedral at least 1½ inches on each side. See the drawings. The dihedral assures stability and prevents the model from diving when thrown at an angle to make it come back to you. This is true only if there isn't something else wrong.

Next cut out the tail surfaces (made of 1/32 soft balsa) and fuselage (made of 3/32 medium) into the shapes shown in the plans. Then cement the tail surfaces to the fuselage. (Note: The rudder is glued to the side of the fuselage instead of to the center. The joint is thus made stronger).



Equipped with power, ready to go through its paces

While these are drying, bend all the wire parts; namely, the landing gear, shaft and rear hook. The shaft *must* be made perfectly straight. The rest is "pie."

Just sandpaper the machine-cut propeller till it is 3/32" thick at the center and 3/64" at the tips, cement the wing to the fuselage (the leading edge of the wing is placed 1¾" from the nose), cement the thrust bearing, landing gear and rear hook to the fuselage and cement the shaft to the "prop." Thread is used to hold the bearing firmly.

Tie the rubber into a loop and the model is ready for flight. And are you going to have fun with it!

When you tire of flying it as an R.O.G. take off the rubber and propeller and further enjoy flying it as a stunt glider.

List of Materials

1 piece	medium balsa	2" x 12" x 1/32" plus
1 piece	soft balsa	2" x 8" x 1/32"
1 piece	medium balsa	1" x 8" x 3/32"
2 wheels	hard wood	¾" diameter
1 piece	music wire	.020" diameter x 9"
1 small	thrust bearing	.025" hole
1 foot	rubber	⅛" flat
2 polished	washers	⅜" diameter
1 dram	cement	colorless
Sewing machine thread		

Webster's Record-Breaking Hydro

How You Can Construct a Hydro of Unusual Performance. Plans Page No. 26

R.O.W. (Rise Off Water) endurance planes or "hydros," have not as yet "stuck" with the majority of model builders; probably due to the fact that few contests have been held which included this event. However, they have been quite popular with Philadelphia model builders, judging by the records hung up in the last few months.

At the P.M.A.A. Championship Meet in June, 1934, Mayhew Webster of 2421 Dauphin Street, Philadelphia, a member of the Northeast Chapter of the National Aeronautic Association, set a new record with a fine flight of 11 minutes, 55 seconds. In doing so, he surpassed his own record set a few months previous of 8 minutes, 35 3/5 seconds.

It is quite likely that model builders will soon come out with something better. A little study of the plans and specifications, which follow, may help those unfamiliar with R.O.W. design, to complete a successful "hydro."

Bill of Materials

All measurements are in inches. Material is balsa wood unless otherwise stated.

Wing
- 4 main spars 1/16 x 3/32 tapered to 1/16 x 1/32 x 8¼
- 4 tip spars 1/32 x 1/16 tapered to 1/32 x 1/32 x 4⅞
- 2 tips outlines 1/64 x 1/32 x 5
- 15 ribs, all 1/32 x 1/32 and of these lengths:
  - 1-R1 = 4⅜, 2-R2 = 4 3/16, 2-R3 = 4/132
  - 2-R4 = 3⅞, 4-R5 = 3 11/16, 2-R6 = 3 1/16, 2-R7 = 2½
- 2 wing clips (see drawing) 1/32 x 1/16 balsa and .016 wire

Motor Stick
- 1 blank 1/64 x 1 at center, ⅞ at ends x 15
- 1 nose cap 1/64 x 1/14 x 7/16
- 1 rear cap 1/64 x ¼ x 11/32
- 1 forged bearing; and 1 rear hook, .016 wire

Empennage
- 1 tail boom (hollow teardrop) blank 1/64 x ⅜ tapered to 3/16 x 10
- 2 rudder posts 1/32 x 1/32 x 2 5/16
- 1 rudder rib 1/64 x 1/32 x 3
- 1 rudder rib 1/64 x 1/32 x 2 3/16
- 1 rudder outline 1/64 x 1/32 x 3
- 4 stabilizer spars 1/32 x 1/32 x 3⅜
- 1 center rib 1/64 x 1/32 x 3¼
- 2 ribs 1/64 x 1/32 x 2 7/16
- 2 tip outlines 1/64 x 1/32 x 4¾

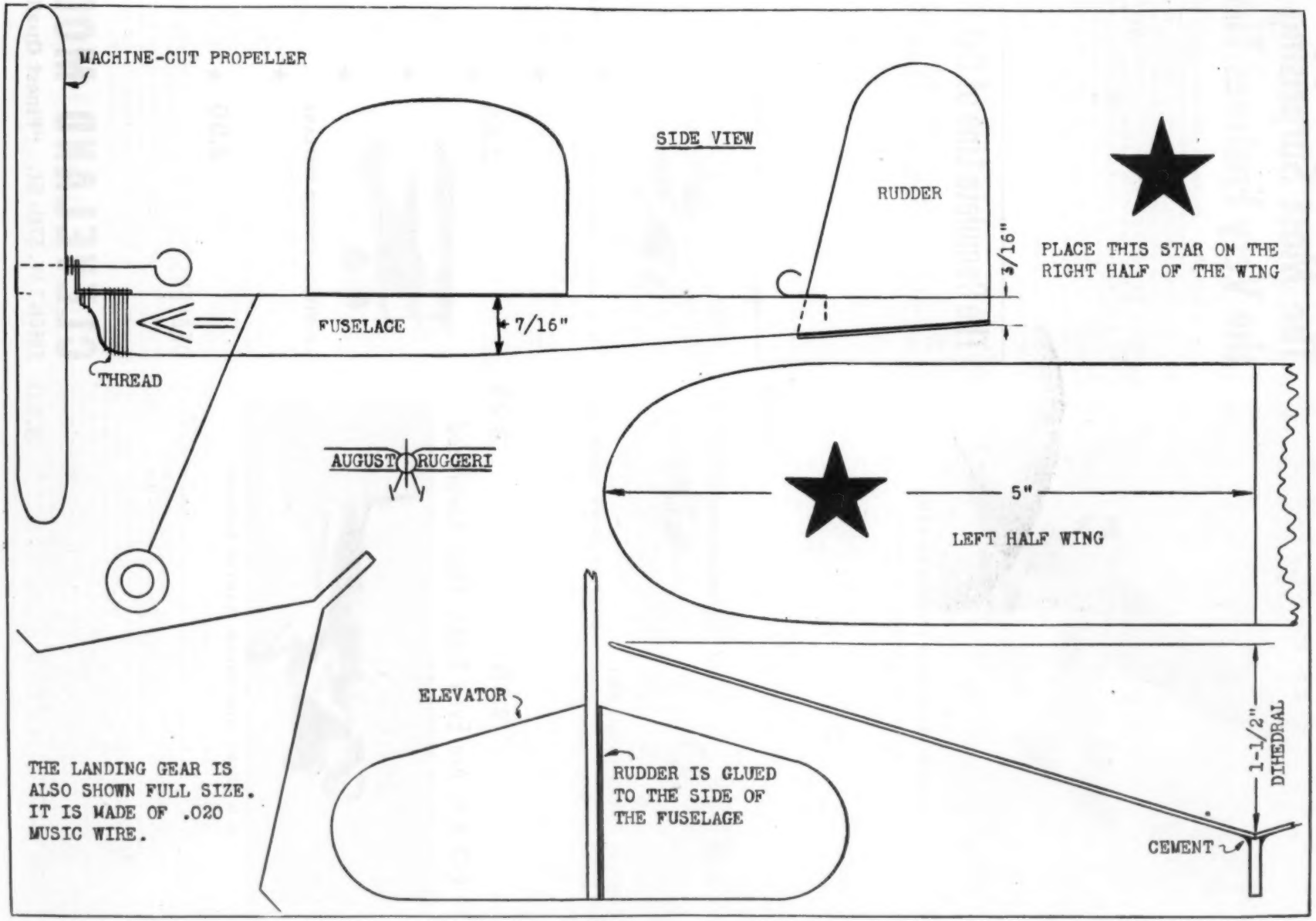
Pontoon Assembly
- 3 pontoons, each consisting of the following and all 1/32 square
  - 2 lower members 1½
  - 2 upper members 1⅝
  - 4 spreaders ½
  - 2 uprights ¼
  - 2 front struts (hollow teardrop) blanks 1/64 x ⅜ tapered to 3/16 x 7
  - 2 rear struts 1/32 x 3/64 x 3¾

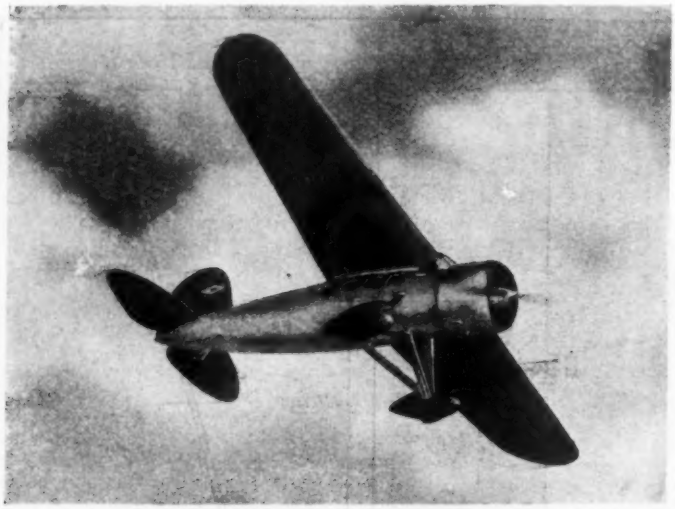
Propeller
- 1 block (quarter grained) 1 x 1½ x 12½
- 1 shaft .016 wire
- 2 bronze washers
- 1 loop rubber, 3/32 x 1/30 (brown), 17 inches long
- Microfilm-flexible collodion, thinned with amyl acetate
- Mean pitch of propeller is 24 inches, camber about 3/32
- Ribs are cut following rib template (see plan)
- Pontoons covered with "verithin" tissue and given one coat of thinned dope

Weight of parts

Propeller	.012 oz.
Wing	.025 oz.
Tail	.004 oz.
Fuselage	.024 oz.
Pontoons	.011 oz.
Total, plus motor	.132 oz.

Motor was given 2000 turns on its record flight.


MACHINE-CUT PROPELLER
SIDE VIEW
RUDDER
3/16"
PLACE THIS STAR ON THE RIGHT HALF OF THE WING
FUSELAGE
7/16"
THREAD
AUGUST RUGGERI
5"
LEFT HALF WING
ELEVATOR
RUDDER IS GLUED TO THE SIDE OF THE FUSELAGE
1-1/2" DIHEDRAL
CEMENT
THE LANDING GEAR IS ALSO SHOWN FULL SIZE. IT IS MADE OF .020 MUSIC WIRE.



WORLD-RENOWNED LOCKHEED VEGA

There have been many commercially produced Lockheed Vega models, but none approaching this authentic C-D beauty which gives the finest performance that could be expected of a large, high winged design, flying high, far and fast. Its span is 30¾", length 21", weight 3.7 ozs., colored brilliant red wing, tail surfaces and wheel shoes, everything else cream except its black detail and wing lettering.

There are 68 pieces in the kit to build this model of which 15 are printed out flat sheets of balsa wood, containing 254 individual pieces. If counted as parts of the kit, would make a grand total of 307 pieces. The above material printed out, in addition to the standard parts contained in all C-D kits, there is also included a printed instrument panel, slotted and drilled "Standard steel" type propeller hub, celluloid for windshield and windows, black tissue for wing lettering and material for scale propeller in addition to the large full sized drawing which contains three large photographs of the completed model. Kit SF-24 ..... $3.25

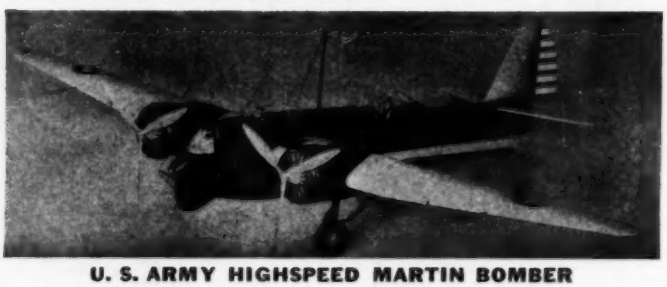
CURTISS F11C-2 (GOSHAWK)

High speed U. S. Navy shipboard fighter. We claim our Hawks (21, 49 and 50) the most accurate and finest to be found anywhere at any cost. Designed for advanced model builders who want a thoroughly detailed scale model and one which, when completed, represents the acme of perfection in scale flying model building. Span 23⅝". Silver, yellow, gray and green, Kit SF-49 ..... $3.75

CURTISS ARMY HAWK P6E

Colored like Hawks in 17th Pursuit group, yellow, olive drab, black and white. Our redesigned model is the most advanced type to be found anywhere. Many details. Often built by the best model builders when "first prize" is sought like our SF-49. Fast flights. Span 23⅝". Kit SF-21 ..... $3.25

C-D Kits Are Even Better Than Advertised



U. S. ARMY HIGHSPEED MARTIN BOMBER

This modern military bomber is representative of American designing skill and is the pride of the bombing squadrons. Known to travel at a rate well in excess of 200 M.P.H., flown by two Cyclone engines, this plane has the ability to out-distance most fast recent type planes. It is versatile. May be used for bombing, attack, observation, transportation of officers, troops and fighting equipment. Our ¾" scale model of this ship proved to be most popular for those builders desiring an extra large size rubber powered model that will fly well. An advantage of this large size is that the parts do not have to be put together with the same precision that smaller types require in order to look and fly well. Our drawings are very complete and easy to follow, having many photographs of covered and uncovered views of model. The kit is very complete and has all special wood blocks bandsawed to shape and size. Cowl fronts, wheels, bearing buttons and flying propeller hubs are already turned. All wood parts printed on sheet balsa and plenty of cements and colored dopes furnished. If you haven't built many models, don't be too reluctant in getting this kit because the drawings leave nothing to your imagination for it's easy to build models the C-D way you know. Span 53¼". Colored yellow, olive drab. All insignia furnished. Kit SF-45, a lot of airplane for only $8.50

The Most Surprising Feature the Very Features That

Most modelbuilders know that all C-D's are authentic scale ... tures of big planes—most modelbuilders know C-D Kits are ... complete (except Dwarfs, which contain no liquids or striping ... —and most modelbuilders know that a finished C-D will put ... beautiful flying performance—BUT until a modelbuilder has ... built a C-D, he's very liable to feel that C-D's are hard to ... And that's the most surprising feature about C-D's—THEY ... DIFFICULT TO BUILD. Yes, it's only natural for anyone to ... models with such amazing authenticity, and such wealth of ... would almost require an expert to construct them—*yet C-D's ... many cases easier to build than ordinary models.* The reason ... C-D plans are crammed with the fullest, most easily followed ... tions possible. Some C-D models are easier to build than ...

The Complete Line of C-D ½" (D...

These are precisely like the ¾" models illustrated here—with ... length of "Dwarfs" take ⅔ the length of the corresponding ... recommend same colors as used on ¾" design of the same ... DO NOT CONTAIN ANY LIQUIDS, or STRIPING TAPE.

No.	Name	Span	Price
D- 1	Gr. L. Sport. Trainer	13 3/8	$ .65
D- 2	Tr. Air. Mystery Ship	14 1/2	.50
D- 9	Army Boeing P12-E	15	.85
D-11	A-W Quad Fighter	14	.45
D-14	Fokker Triplane	11 3/4	.45
D-15	Fokker D-7 Fighter	14 1/8	.60
D-17	Bayh's '31 Gee-Bee	11 3/8	.50
D-18	Howard "Pete" Racer	10	.30
D-19	Supermarine S.6B	15	.65
D-20	Hawker Fury Fighter	15	.45
D-21	Hawk P6-E Fighter	15 3/4	.75
D-23	Boeing P-26 Fighter	14 1/8	.65
D-24	Lockheed Vega	20 1/2	.85
D-26	Heath Parasol Sport	15 1/2	.35
D-27	Doolittle's Gee-Bee	12 1/8	.50
D-28	Monocoupe Sportplane	16	.45
D-29	Boeing F4B-3 Fight	15	.85
D-32	Boeing 95 Multiplane	22 1/4	.85
D-33	Comper Swift Lightpl	12	.30
D-35	Boeing 247 Transport	26 7/8	2.50
D-36	Lincoln Sportplane	10	.25

All kit prices are postfree anywhere—no pa... arge.

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FOKKE... FIGH...

Used by Germa... t earne... tation of mos... t figh... world war is a... service, ... maneuverable a... make ... without sheddi... wings. ... model is 100% ... ic, and ... colored, orange ... and wi... flights. Kit ... SF-15 .....

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Flown by the famous Red Knight before the close of the war. Colored brilliant red with silver nose and white markings, it was easily distinguished from other "tripes"—and avoided by opponents. Quick maneuvering and climb were characteristic of both the prototype and model. Span 17⅝". Kit SF-14 ..... $2.50

HOWARD ... ER "...

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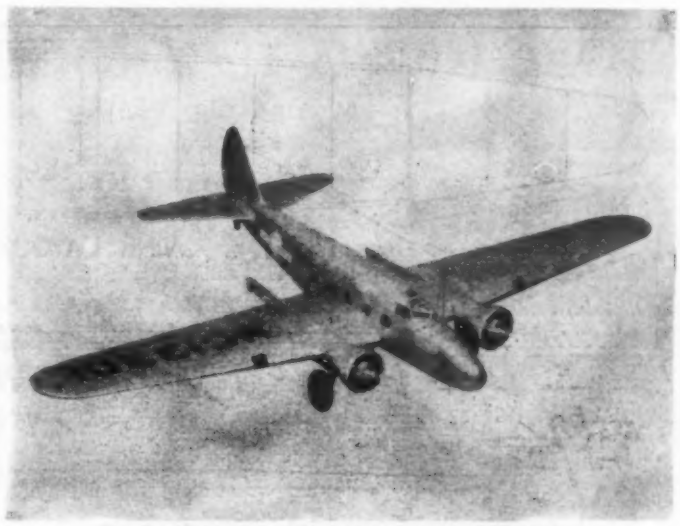

FAMOUS BOEING 247 TRANSPORT

Boeings of this design have been on the airlines for three years, having built up a reputation for their speed and dependability. Planes of this type have given the U. S. the title of having the best commercial airlines and airplanes in the world. These planes are years ahead of their time, and this fact is reflected by the gradual trend toward this design by aeronautical engineers throughout the world. This type of ship with its two P. & W. Wasp engines will cruise from 160 to 180 M.P.H. They are equipped with two way radio communication and all the latest instruments for blind flight. Large scale models of this type fly beautifully. Many of our orders indicate that several enthusiasts have "chipped in" to buy the kit so that each could have a part in building the plane. Don't let this statement disillusion you however, because many builders of only average experience have built it without help. The parts require no special tools or machine work to finish the model. Wood patterns are all printed out on large sheets of balsa which save so much time in building. Wheels, speed rings, bearing buttons, flying propeller hubs, etc., are furnished ready to assemble. Plenty of cements and colored dopes, etc., furnished. This latest authentic kit is in no way comparable to our earlier silver colored model. Wing span 55⅝". Colored all gray with black details. Kit SF-35 ..... $8.50

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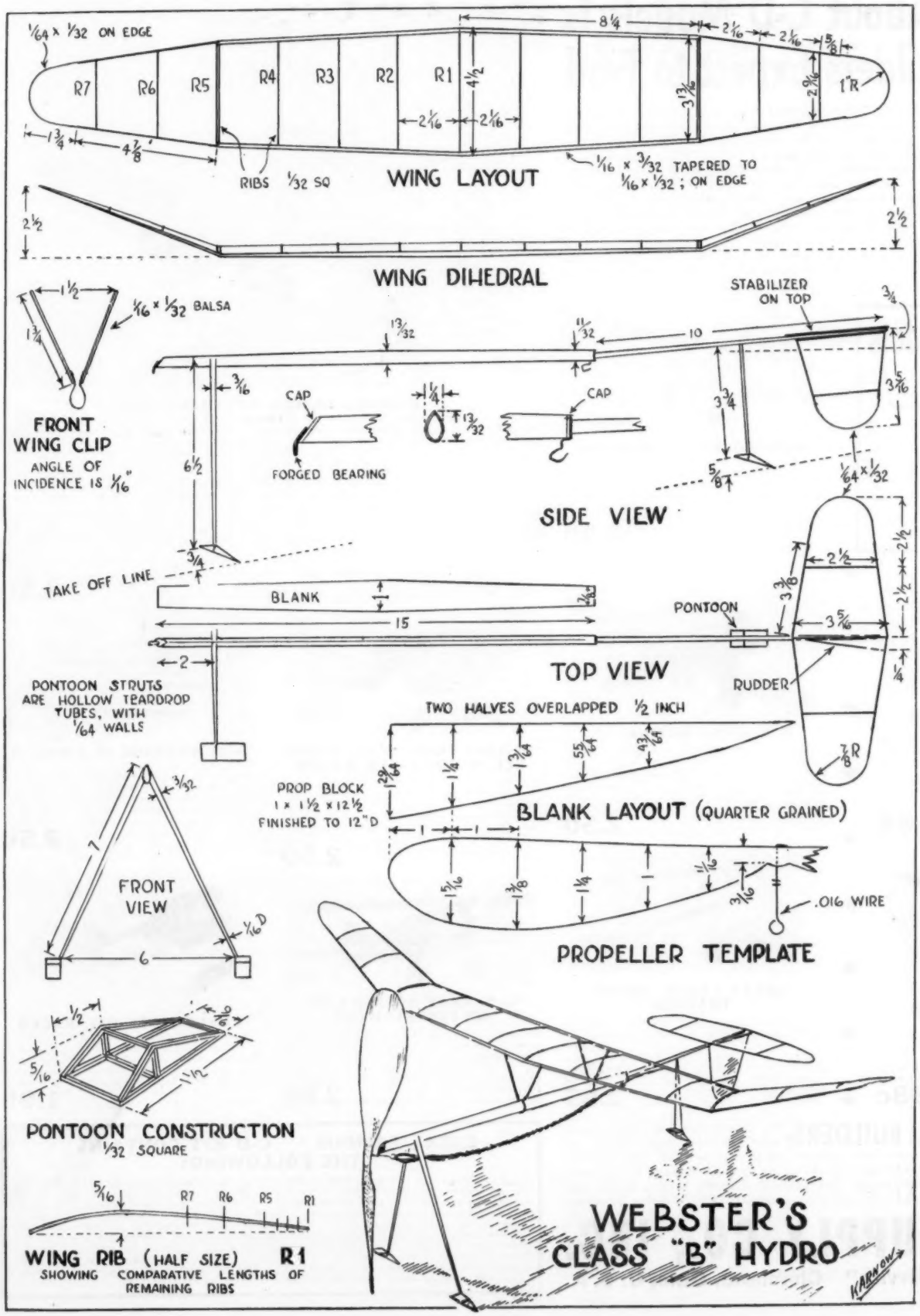

1/64 x 1/32 ON EDGE
R7
R6
R5
R4
R3
R2
R1
8 1/4
2 1/16
2 1/16
5/8
1"R
4 1/2
3 13/16
2 9/16
1 3/4
4 1/8
2 1/16
2 1/16
RIBS 1/32 SQ
WING LAYOUT
1/16 x 3/32 TAPERED TO 1/16 x 1/32 ; ON EDGE
2 1/2
2 1/2
WING DIHEDRAL
1 1/2
1/16 x 1/32 BALSA
1 3/4
FRONT WING CLIP
ANGLE OF INCIDENCE IS 1/16"
13/32
11/32
10
STABILIZER ON TOP
3/4
3/16
CAP
1/4
13/32
CAP
FORGED BEARING
6 1/2
3 3/4
3 5/16
5/8
1/64 x 1/32
SIDE VIEW
3/4
TAKE OFF LINE
BLANK
1
2 3/4
15
PONTOON
2 1/2
3 3/8
2 1/2
2 1/2
3 5/16
2
PONTOON STRUTS ARE HOLLOW TEARDROP TUBES, WITH 1/64 WALLS
TOP VIEW
RUDDER
1/4
TWO HALVES OVERLAPPED 1/2 INCH
29/64
1/4
3/64
5/64
43/64
7/8 R
PROP BLOCK 1 x 1 1/2 x 12 1/2 FINISHED TO 12"D
BLANK LAYOUT (QUARTER GRAINED)
1
1
3/32
7
FRONT VIEW
1/16 D
6
5/16
3/8
1/4
1
1/2
3/16
.016 WIRE
PROPELLER TEMPLATE
1/2
9/16
5/16
1 1/2
PONTOON CONSTRUCTION
1/32 SQUARE
5/16
R7
R6
R5
R1
WING RIB (HALF SIZE) R1
SHOWING COMPARATIVE LENGTHS OF REMAINING RIBS
WEBSTER'S
CLASS "B" HYDRO
KARNOW

Secrets of "Indoor" Construction

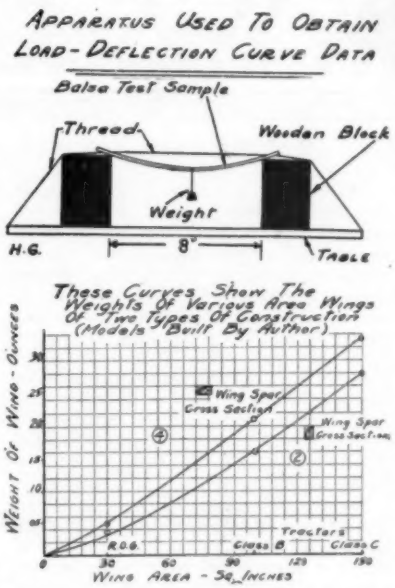
How to Make Your Indoor Models Lighter and Stronger by Careful Structural Design

By HERBERT GREENBERG

THE design of the modern indoor tractor model has been evolved only after nine years of patient research, and it seems that this design will not change greatly as the years pass. We may expect to see elliptically-shaped surfaces, hollow sticks, long tail booms and microfilm props on tractor models for many years to come, but even though we may not perceive a great radical change in design, we must expect to see records broken regularly. Model airplane engineers are satisfied, it appears, with the present day design and are improving on their models by getting more out of them than they have previously. In other words, the indoor model is being made into a more efficient machine. Greater efficiencies have been obtained not by merely changing designs but by improving on the details of construction.

In order to illustrate how this change in construction details has been an important factor in raising durations, let us consider the indoor tractor wing. Through the use of microfilm, we have lightened our former paper-covered wings by one-half. Since the weight of the wing is a large percentage of the total weight of the model, the total weight of the modern indoor model is much less than that of its forerunner—the paper-covered ship. It is a well-known fact that lightening a model to such an extent will enable one to obtain greater duration with it. Proof of this fact is easily shown by comparing the designs and performances of the winning 1932 and 1933 indoor tractors. It must be agreed that the designs of both years' models were practically identical, but the 1933 indoor tractor had a longer duration because of its lighter weight.

If observance of the various types of wing spars is made, one may learn a few startling facts. There are four common types of wing spar cross-sections in use today. For purposes of reference in the drawings, these spars will be numbered 1, 2, 3 and 4. In deciding which type of spar to use in construction, the model builder must consider a number of factors; namely, the weight, rigidity and air resistance of each type of spar. Many model builders are content to use one type of spar without knowing why they chose that particular type, and in a great number of cases these builders are handicapping themselves and lessening their chances of securing good duration from their models. It is perhaps natural that this neglect is quite prevalent among model builders, because a wing spar may seem to be an item of no great importance requiring only a minimum of attention in the design of a wing, but if tests are made to determine the weights and strengths of wings using the various types of construction, a great deal may be learned.



These Curves Show The Weights Of Various Area Wings Of Four Types Of Construction (Models Built By Author)
Weight Of Wing - Ounces
Wing Spar Cross Section
Wing Spar Gross Section
Tractors
R.O.G.
Class B
Class C
Wing Area - Sq. Inches

Many fellows may complain that they have trouble with wings washing out and may ask how they can remedy this difficulty without increasing the weight of the wing. It is really surprising to find out that by merely shifting the main axis of the cross-section through ninety degrees or performing some other seemingly minor change, a revelation in performance may be obtained. A flimsy wing may never be depended upon for record-breaking performance, as it always has the tendency to change its adjustment and make the model on which it is used appear erratic.

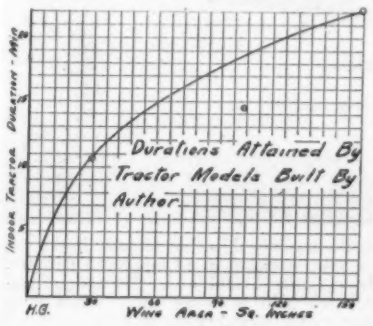
In order to determine which type of spar arrangement to use in wing construction, the author carried out a number of tests with the apparatus illustrated. By placing various loads on a specimen of balsa spar and noting the deflection of the spar from the horizontal (thread), a set of data was obtained. The data was tabulated and a curve was drawn up. This static load test curve shows a number of surprising and interesting facts.

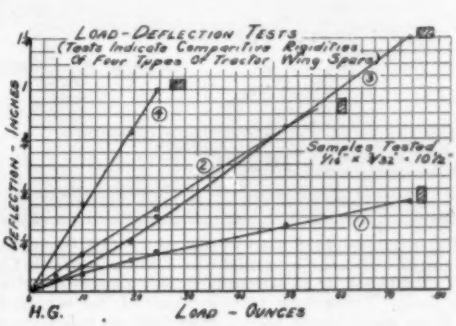
Obviously the type of wing spar which is deflected the least amount for a given load is the most rigid. A study of the curve will show the order of rigidities from greatest to least to be 1, 2, 3, 4. A glance at the graph will show that the deflection varies almost directly with the load and that moreover, the curve with the greatest slope gives the rigidities of the strongest type of spar, and the curve with the least slope gives the rigidities of the weakest type of spar. A number of the country's foremost builders still use type 4 spar, but a glance at the graph shows the inferiority of this type of spar as compared with type 1. However, one may lose a large amount of efficiency by using type 1 because of the greater air resistance that it offers. Nevertheless, this type should be preferred to type 4, as the model will be much more consistent. One or two of the models that have done over twenty minutes, used spar 1 in their wing structures. Models built by the author employ type 2 spar.

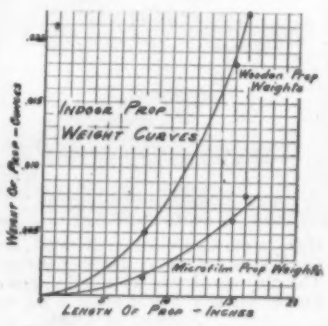
The weight of a wing varies with the type of spar used in its construction, as may be noted in the drawing illustrating the wing area-weight relationship. The reason why the type 4 spar construction is heavier than the type 2 construction lies in the explanation that the type 4 spar must be made larger in cross-section and consequently heavier in order to secure the rigidity necessary for consistent performance.

Model builders of Boston, among whom may be included Torrey Capo, Bruno Marchi, Wilbur Tyler and Louis Young, use an entirely different wing construction than do other builders. They make their wing frameworks exceedingly light by using round spars of small cross-section, and to secure the necessary rigidity they brace the center section of the three-section wing

(Continued on page 30)




Load-Deflection Tests
(Tests Indicate Comparative Rigidities Of Four Types Of Tractor Wing Spars)
Deflection - Inches
Samples Tested 1/16" x 1/32" - 10 1/2"
H.G.
Load - Ounces



Aviation Advisory Board

Conducted by
CHARLES HAMPSON GRANT
Chairman of the Board
Formerly of
The Technical Section, Air Service, U.S. Army

MANY questions have come in to the Advisory Board which have been answered in previous issues of MODEL AIRPLANE NEWS. We suggest that readers who have questions to ask read through Advisory Boards of previous issues. Possibly their question may be answered in them. Lately we note that a great many questions which are fundamental in model building and aerodynamics have been sent to us. One of these questions, which is probably the most important one in airplane design, comes from George Sholes of 55 Holburn Avenue, Cranston, Rhode Island. He wishes to know:

Question: How does an airplane wing get its lift? In his letter he outlines his understanding of it, but there are one or two things in which he is in error. Suppose we go over the matter briefly here.

Answer: When an airplane wing moves through the air, the first consideration is that the front edge must be elevated sufficiently so that the lift or resultant pressure on the wing pushes upward and not downward. If the leading edge is depressed too much, the resultant pressure will push downward. In other words, the wing must have a positive angle of attack. This condition causes a partial vacuum to be produced over the upper surface of the airfoil and an additional pressure over atmospheric pressure to be added to the underside of the wing. If the atmospheric pressure is fifteen pounds per square inch we may take the following as typical values of vacuum and pressure.

The vacuum will be over the wing, in this case, fourteen pounds. The pressure beneath the wing, fifteen and a third pounds per square inch. Thus the decrease in pressure is three times the increase in pressure. The difference in pressure is one and a third pounds per square inch. Of course these values are extremely high in relation to actual practice, but they serve as an illustration of our point.

Sholes wonders about the following:

Question: Why will an airplane not fall downward instead of lifting when it is flying upside down?

Answer: Whether this occurs or not depends entirely upon the angle of attack of the wing. If, when the airplane is flying in the inverted position the leading edge is actually dropped below the point of zero of lift, the pressure will be downward. However, if it is raised above zero lift, it will give lift and support the plane. Of course, when the plane is in the inverted position dropping the leading edge is equivalent to raising it when the plane is in normal flying position. We mean by this that the leading edge should be dropped relative to the earth. Whether the wing lifts or pushes downward depends entirely upon this angle of attack, whether inverted or in normal flight.

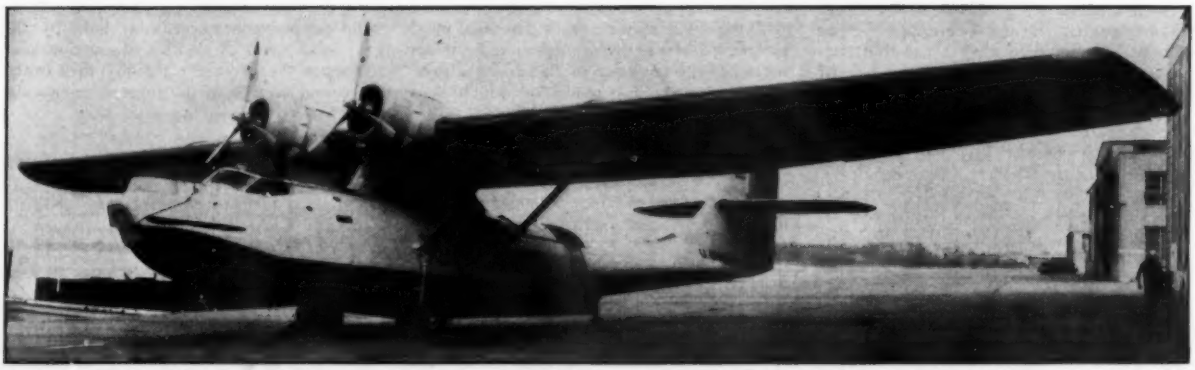
We hope that this answers not only Sholes' question but possible doubts that may exist in the minds of other readers. Sholes asks another question which is very important and, generally speaking, embodies the reason why large planes are not as stable as models. He wishes to know:

Question: Why the stabilizers on large planes are not large enough, inasmuch as the speed of larger airplanes is much greater than models and therefore the stabilizer is more effective.

Answer: On the surface this might appear to be so; however, Sholes is leaving out one very important point. The weight of large airplanes and the inertias involved are also very much greater. In other words, the weight of a large airplane is increased to such an extent that a very much larger wing must be used at any given speed. Naturally, if the area in the wing is intended to lift the weight of the plane, the area in the stabilizer can not be more effective per sq. ft. than the wing area at the same speed. Everything increases proportionately as the size of the plane is increased. The reasons why large airplanes at present do not have large stabilizers are:

Large stabilizers give greater resistance and greater resistance defeats the one object which has become a mania with present day designers; that is, speed. Due to the intense competition of one man to outdo another, speed has been emphasized primarily, while safety has been relegated to second place. True, safety has been considered, but only after speed has first been established. Due to this policy, tail areas are made as small as

(Continued on page 45)



Here is the Consolidated XP3Y-1, the latest twin-engined patrol plane of the U.S. Navy. It is the mystery ship that recently broke the world's record for non-stop distance flight of seaplanes by a flight of 3,300 miles from Coco Solo, Panama, in 34 hours, 15 minutes. The old record was 3,016 miles, recently established by an Italian flier with a flight from Italy to Italian Somaliland. The unique feature of the new patrol plane is the wing floats. These floats form the tips of the wings when the ship is in the air. When it is desirous of landing, the floats swing down into correct position below the wing. (See picture page 10.)

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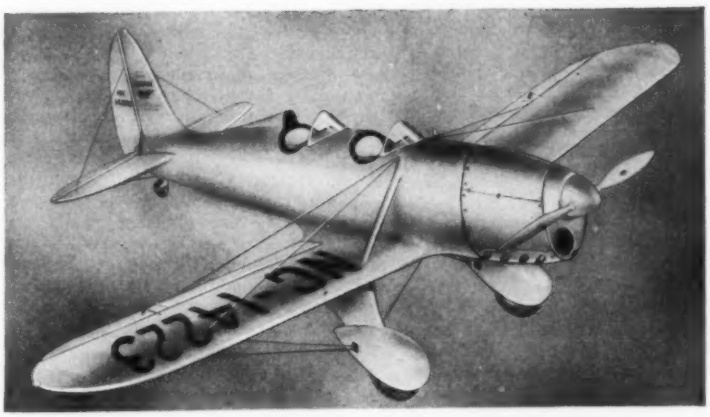

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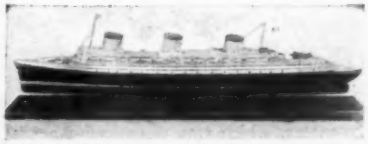

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War Birds of Italy

(Continued from page 6)

and the plane is a convertible land and seaplane. The top speed is 141.8 m.p.h. (which probably means service rather than test speed) and it is equipped with slots and flaps to overcome any difficulties encountered as the result of poor catapulting.

Another interesting Piaggio design is the small P-8 used as a submarine spotter. It has low power with unusually large wing span and floats, which combination cuts the top speed down to 81 m.p.h.; seats a pilot and observer, has a 75 hp. Cirrus III engine and has the unusual feature of being all-metal. A large number of these craft are stationed in all the Italian seaports, where their slowness, curiously enough is an advantage instead of a drawback in the work for which they are designed. Submarine spotting and bombing from airplanes has always suffered from the difficulty that the airplane overshoots its mark too rapidly and has to turn back and find it all over again. These Piaggios with their low speed and narrow turning circle seem very well adapted for the purposes of their design.

For the same purpose the Italians have done a great deal of experimenting with autogiros and a single autogiro is now part of the standard plane equipment on the new cruisers of the *Montecucculi* class, the Italians feeling that this type of plane not only meets the needs of a submarine spotter but is also particularly useful as a shipboard observation plane.

The training planes of the Italian Air Force are a combination of sport planes and trainers. The most recent is the Caproni Ca-125. Designed as a sport plane originally, it is being largely used as a trainer because of its fine flying qualities. The design has produced considerable excitement in aeronautical circles, as the fuselage has somewhat the shape of a pigeon's body, large and rounded at the front, tapering backward toward the tail. Mr. Gianni Caproni, the designer, is reported to have spent years on this revolutionary design and his results have even exceeded his expectations. The plane is powered with a Colombo S-63 engine and makes 130 m.p.h., which is plenty for a trainer or sports plane, and is equipped with Handley-Page slots, as well as attachable twin floats. A slightly older trainer is the Caproni Ca-113, somewhat more conventional in design and generally used for advance training and acrobatics. It is a single-seater, top speed 157 m.p.h., with a wingspread of 36 feet and a length of 24 feet, the distinguishing characteristic being, as with so many of the Italian craft, sturdiness and reliability.

The Italian Air Force certainly does not show as high speeds as some others, but this cannot be due to any fault of Italian designers or builders, for after all, the world's fastest plane is Italian and the second-fastest also. The lower speeds in military craft would seem to mean simply that for the peculiar needs of Italian air strategy, reliability, is more important than speed.

Secrets of "Indoor" Construction

(Continued from page 27)

with the finest tungsten wire available.

In order to prevent their wing tips from washing out, these builders employ wing tip stabilizers which are tails about the size of those used on R.O.G.s, set on short booms and glued to the rear of the wing tips' trailing edges. The performance of this type of model do not seem to warrant using the design. The best time attained by that design is 19:19 minutes, which was made by Bruno Marchi at St. Louis. Marchi's ship used a microfilm prop. It is probable that better endurance than this is possible with the Boston design.

The tear drop shaped motor stick has helped lighten the weight of a tractor model considerably. Besides being lighter in weight than the built-up stick, the tear drop type is much easier to construct and is stronger. The trend in motor stick design is to use a stick having thin walls but a large cross-section, and by tapering the stick longitudinally, great strength to withstand the bending effect of the rubber motor is secured. Cans which had been used on the built-up stick to prevent it from snapping, are unnecessary for today's design.

The most important single part of a model, in the opinion of the author, is the propeller. A model entered by the author in the St. Louis Nationals remained in flight for only a little more than sixteen minutes with a seemingly inefficient wooden prop. When this prop was removed and a microfilm prop was substituted, the model immediately became a record-breaker. Its first flight with the "mike prop" was 21:47 minutes and subsequent flights were of greater duration. The performance of this model was indeed beautiful and the prop turned over at a speed of only forty-six r.p.m. during the middle portion of the flight. The speed of most of the props at the meet was from 70 to 90 r.p.m.

The difference between the particular prop mentioned and most of the others was that it had a different blade shape in that most of the area was concentrated near the center of the blade, and the pitch of the prop was excessively high, so that ⅛ inch rubber had to be used. The model had so much power that the rubber had to be deadened by a number of prewinds, and consequently it was not necessary to change the rubber after every flight. In fact, it was quite advantageous to use the old rubber as a great increase in the number of turns was gotten in each successive wind. The motor, which was wound with a 27:1 ratio winder, needed only relubrication after each flight.

The performance of this model serves to indicate that weight doesn't mean everything, but rather efficiency is to be preferred. The model weighed complete about .150 ounces. The wing was fairly light, as it weighed .028 ounces. The fuselage was exceptionally heavy, weighing .022 ounces, but it served to lower the center of gravity of the ship. The tail unit with boom weighed approximately .013 ounces and the microfilm prop which had a length of sixteen inches weighed only .008 ounces. Even though it was a trifle more than one-third the weight of the wooden prop, it was about three times as rigid as the latter. The combination of high-pitched microfilm propeller with a large amount of power worked very well. In fact, this is the only type of microfilm prop that worked with any degree of success. On May 18th, 1935, at a record-breaking meet held at Lakehurst, New Jersey, the author tried a combination of a medium-pitched propeller with a small amount of power. This experiment turned out to be very unsuccessful, as the propeller spun very fast and the model scarcely moved. It is possible that this occurred because the pitch was not the same on all parts of the blade.

The chief advantage in using a microfilm propeller is to lessen the total weight of the model. This advantage is shown in the drawing illustrating the weight relationship between wooden and microfilm props. The graph shows at a glance the weights of any size of microfilm or wooden prop. It may be noted that the weight of a microfilm prop is a little greater than one-third that of the older type. The props which the curves represent were not constructed from a previously carved wooden prop, but were entirely built up. The most tedious operation—that of getting the correct blade angle for each portion of the blade—was accomplished by building the entire prop on a block in which these blade angles had been set. The method of carving a wooden prop, cutting out most of its area and replacing the empty space with ribs, is in the author's opinion, a poor one since it is quite impossible to get this type of prop light enough to be of any advantage.

In the hope of finding the relationship between wing area and duration, the author drew a graph using values which he obtained using his models—no other data being available. The curve slopes in the anticipated direction and indicates that indoor duration may be increased if the wing area is increased.

Incidentally, while discussing the curve, it may be noticed that one point does not lie on or anywhere near the curve. This is due to the fact that the model with which the duration was secured, was flown in an arena which has a ceiling of only sixty feet. It is entirely possible that if the model were flown in a higher place, it would have reeled off a flight having the duration shown on the curve.

It is possible, if the data from which the curve is drawn is considered authentic, that flights of twenty-seven or twenty-eight minutes may be gotten with models of two hundred square inches of wing area. But the building of models having greater areas than one hundred and fifty square inches, ought not to be encouraged because of a number of reasons. First of all, it would be impossible to acquire places high enough and large enough in which to fly such models. Secondly, model builders in their attempts to build larger models, would lose sight of the mark which they are leaning towards—the improvement of a design by increasing the efficiency of the model. To merely secure a longer duration by using a large model is not what should be striven for.

There were a number of interesting things to be noticed at the St. Louis meet

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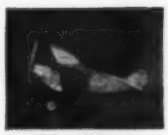

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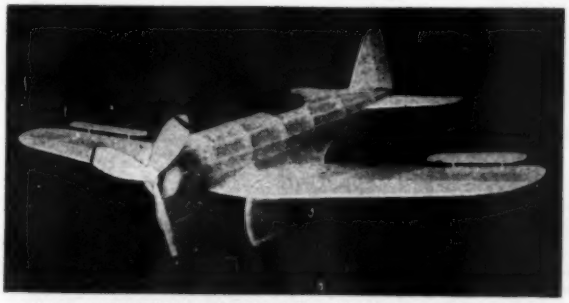

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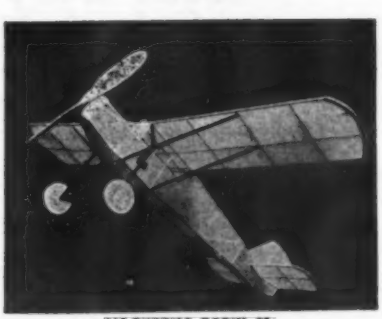

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this year. All of the high place winners in the Bloomingdale event used commercials with a maximum amount of wing area; that is, one hundred and fifty square inches. The author tried to get away with what he did last year—place among the higher winners by using a class B model. The performance of the model proved that the builder was seriously handicapping himself, for the model got consistent flights of only eleven minutes, whereas last year's class B model got flights of thirteen minutes. The model used this year differed from last year's model in one respect only, but that was enough to keep the duration down by two or three minutes. Instead of using a six inch boom as in the 1934 model, a 10 inch boom was used. In accordance with the rules a much larger cross section had to be used. The resistance of this fuselage was enough to require that ⅛ rubber be used. The propeller naturally turned faster, but a height of about eighty feet was all the model could attain. The winning commercial models had short booms and were able to get height at the beginning of flight. After noting the performance of his newest commercial design and comparing it with last year's design, the author determined to rid himself of his troubles by adhering to the latter design and improve on it by carrying out construction work more faithfully.

The Junior Birdmen indoor meets which were held in New York in December, 1934, and in Detroit in April, 1935, presented some keen competition. A number of excellent R.O.G. designs were to be seen at both of the meets. In New York City, Henry Struck made an unofficial flight of 10:57 minutes with his beautifully built model, and possibly he could have done 12 minutes if the ship hadn't hit a wire and lost half of its altitude. The wing of Struck's model was built in two pieces, was elliptically-shaped, and weighed .004 ounces. The motor stick was of conventional hollow tear drop design and weighed .006 with the tail assembly and landing gear attached. The eight and one-half inch prop, powered by a loop of one-thirty second inch flat brown rubber, weighed .005 ounces. These weights are more or less standard now, and a builder may judge his own ship's lightness by using these weights as the standard.

A model entered by the author in the same event placed second to Struck's with a flight of 8:30 minutes. This model had a microfilm prop which turned over very fast. The ship dead-sticked from the top of the armory in which it was flown. The same type model flown by the author in Detroit and using a very high pitched wooden prop made consistent flights of over ten minutes under the sixty foot ceiling. The propeller was so slow that the r.p.m. could be counted very easily, and it might be said that it was as slow as a tractor prop. This ship, it is expected, is capable of fourteen minutes.

The R.O.G. model entered by Walter Getsla in the same meet was slightly out of the ordinary, as it had no rudder at all. Instead, the elevator of this novel design was bent down in a cathedral angle. Such procedure is hardly worthwhile for, even though the tail is lighter and has less air resistance, the advantages gained are more than compensated for by the loss of lift of the elevator.

It is indeed a shame that the baby R.O.G. event is not a part of the regular indoor program at the national meet, for this type of model gives one the least bit of trouble and more fun than any of the other indoor types.

Navi-Goid

(Continued from page 9)

"Do you really believe you can reach California?"

"That's what a lot of people want to know. We have a capable enough plane and the weather reports are satisfactory. However, they can't be depended upon to any great degree. That's just how the matter stands."

The youth paused. "That's all, sir, only . . ."

Carroll looked up. "Only what?"

"I was wondering how you can fly across all that ocean and still know where you are going to land. Don't you get lost?"

The Captain chuckled in his amusement. "Well, sonny, that's the biggest question you've asked yet. Suppose you'd remember it if I did tell you all about it?"

"I . . . I'll try, sir. You see, we have a club, and I volunteered to ask you."

"Well, in that case, I shall. Sure you've got plenty of time?"

"Oh, yes, sir. That is, if you have, sir."

The Captain searched through the desk drawers and accumulated an odd assortment of paper, books and pencils on the desk. "Pull your chair over," he said, "I've got some pictures here."

The youth drew his chair until it touched the desk. The Captain was pointing to a chart on one of the pages.

"Well, Charles, when you're out over the ocean and want to know your exact position, there are ten (10) cardinal points you must know. They are:

1. Time.
2. Altitude.
3. Airspeed.
4. Groundspeed.
5. Drift.
6. Deviation.
7. Variation.
8. Whether you are using a chart or a map?
9. True scale of miles.
10. Magnetic compass reading.

"Gosh!" the youth exclaimed.

Carroll laughed. "Takes your wind, eh? But don't worry too much. You see, I gave it to you in a stiff dose. Those ten points cover everything. Three of them you know beforehand, and the other seven take but a short time to determine. I'll tell you what I'll do. First, I'll tell you just what each of these ten points is, and how it is used, then later, we'll work out a little flight of our own. How will that be?"

"Gee, that'll be fine, sir."

"All right. Number one is TIME. We note the time we left the airport, so that later, when we check the time, we know just how long we've been flying. So, knowing the speed at which we flew per hour, and the direction, we can easily de-

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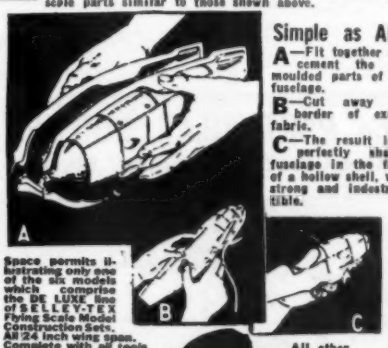

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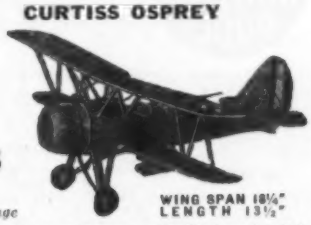

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termine the position."

"I know," the youth said, "If you are flying at a groundspeed of 100 m. p. h. (miles per hour) for three hours, and your direction is southeast, you are three hundred miles S.E. of your airport."

"That's right. I'll draw a diagram of it for your club. You see, we have the scale of m. p. h., the direction and the airspeed, which gives us our position at the end of three hours." (Figure FF.)

"Now we come to ALTITUDE. It is simply a matter of reading the instrument called the Altimeter. You see, the Altimeter indicates the height above a given level. It has a small knob with which you can adjust the needle to zero. If you are flying over the ocean, you would adjust it to ocean level. If your airport is on land which has a general elevation of 1,000 feet, you would still adjust the needle to zero, even though there is an elevation, so that you know your height above the surrounding area of your place of departure."

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"The Altimeter records the heights in thousands and in single feet. There are two hands, just like a pocket watch, the larger of which indicates the thousands of feet, and the smaller, individual feet. The reading 9.30, would be nine thousand and thirty feet. 12.87 would be twelve thousand and eighty-seven feet."

(To be continued)

Navi-Goid Vocabulary

AIRLOCK . . . obstruction of a fuel line by entrapped air.

AIRMARKING . . . a sign usually placed on a roof or highway to serve as a guide.

AIRSPEED . . . rate of movement of an aircraft in relation to the air, *independent* to the horizontal wind speed.

AIRSPEED METER . . . an instrument for measuring the airspeed of an airplane.

ALTIMETER . . . an instrument for measuring the elevation of an aircraft above a given level.

ANEMOMETER . . . an instrument for measuring the speed of the wind past a fixed point.

ANGLE OF DRIFT . . . the angle between the motion in relation to the air and the motion in relation to the ground, which is due to a crosswind.

ARTIFICIAL HORIZON . . . an instrument, of the gyroscopic principle, for registering the actual angle of the airplane in relation to a true horizon.

BALANCED FLIGHT . . . the condition under which an airplane will maintain steady flight without manual pressure on the controls.

BANK INDICATOR . . . an instrument for indicating skidding or slipping, sidewise motion of the airplane.

BEARING . . . the direction in which an object is located in relation to an observer.

CALIBRATION . . . to mark off in degrees, or in scale.

CEILING OF VISIBILITY . . . the altitude of the bottom surface of the lowest layer of clouds.

CROSSWIND . . . headed nearly at right angles to the direction of the wind.

DEAD RECKONING . . . determining position by estimating the direction, speed and duration of flight relative to the air from a known starting point.

DEVIATION . . . compass error caused by magnetic forces carried by the plane. This error changes according to the heading of the plane relative to magnetic north.

DOWNWIND . . . in the direction toward which the wind is blowing.

DRIFT . . . to be carried by the wind.

ENDURANCE . . . the length of time an airplane's fuel supply will last on a cal-

GREAT CIRCLE COURSE . . . the shortest surface distance between two points on a sphere.

GROUND FOG . . . a thin layer of fog close to the ground.

GROUND SPEED . . . the horizontal velocity of an aircraft in relation to the earth.

GYROSCOPIC COMPASS (directional gyro) . . . an instrument containing a spinning wheel which tends to maintain a fixed direction in space. It does not rotate like fixed compasses but does wander slowly and must be reset at short intervals from some positive direction finder.

GYROSCOPIC HORIZON . . . a pendulum which tends to remain perpendicular to the true horizon due to the restraining momentum force of a spinning wheel.

GYROSCOPIC PRECESSION . . . the cross turning of a rotating body whose axis is being forcibly twisted.

"HIGHS" . . . anti-hurricane areas of high barometer pressure usually several hundred miles across the accompanied by clear, cold skies.

"LOW" . . . abbreviated term for a large area of low atmospheric pressure which presages stormy weather.

MAGNETIC DIRECTIONS . . . directions measured from magnetic north, the exact northerly direction of the earth's magnetic field.

PITOT TUBE . . . a nozzle into which the impact pressure of a moving force is exerted and from which the force's speed can be indicated by a pressure gauge.

POSITION . . . state of being placed.

RHUMB LINE COURSE . . . a course of constant heading relative to true north. Same as a straight line on a Mercator chart. Longer than great circle course for extended flights in high altitudes.

SPEED, CRUISING . . . airspeed in level flights with the engine developing the continuous power recommended by the manufacturer.

STATIC . . . pertaining to bodies at rest or in equilibrium.

TACHOMETER . . . an instrument for indicating the rotating speed of an engine.

VARIATION . . . compass error caused by the earth's magnetic field not lying in a true north plane at all points.

(Definitions Courtesy of Lt. Ross Mahachek, *Airplane Pilot's Manual)*

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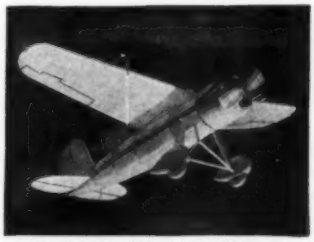

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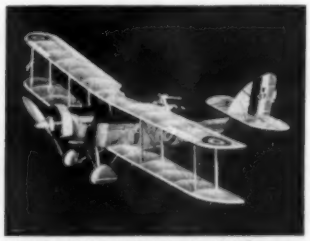

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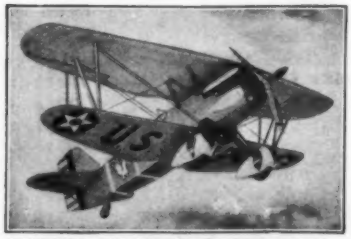

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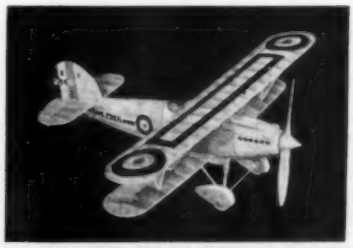

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How to Design Your Model Planes

(Continued from page 13)

the factors should be considered and the design developed will be outlined here. What the correct values of the factors for wing area, stability area, etc., and how they are to be determined, will be shown later. Then a simple method suitable for beginners and a more precise though complicated one for experienced builders will be given.

Procedure of Design

When attempting the design of a model plane, it will be found helpful if the characteristics of the model are considered in the order given as follows:

1. The *purpose* for which it is intended.
2. The *arrangement* of aerodynamic factors that will fulfill the purpose best.
3. The *type* of model most suitable for the purpose.
4. The *size* of the model.
5. The relative *proportions* or size of each structural or aerodynamic factor.
6. The *shape* of the features of the model.

These all should be considered carefully in the light of the purpose for which the model is intended. In this case, it is our desire to design a *stable* model, sacrificing all other qualities to this ideal. If the objective was duration then this would influence our design primarily, except when its demands on one hand apparently impaired stability on the other. In such a case, stability must be given first consideration, for without stability there can be but little capacity for duration.

While we are planning the design for stability, the designer should still have an eye for aerodynamic efficiency, making the arrangement, proportions and shape of the structural and aerodynamic factors, contribute to the flight capacity *whenever they do not detract from the essential stability of the craft.*

Arrangement of Aerodynamic Factors

Now let us proceed to outline the general design. The next consideration is the arrangement and size of the aerodynamic factors that suit our purpose best. Here we jump right into the problem with both feet. Before we can discuss this intelligently, it is necessary to know what these factors are; so they are listed as follows:

1. Center of lift; 2. Center of gravity; 3. Line of thrust; 4. Point of thrust; 5. Stabilizer reaction; 6. Fin reaction; 7. Wing dihedral; 8. Center of lateral area; 9. The individual weights of the structure comprising the model.

We know the following facts about the arrangement or relative position of these factors when stability is the main consideration.

Considering the establishment of longitudinal stability first, the first thought is the position of the center of lift relative to the center of gravity. It is an axiom among model builders to locate it *above* the center of gravity. This creates a pendulum and righting effect, longitudinally and laterally. (Read chapter No 3 of this series of articles for further information; November 1933 to October 1934 issues of MODEL AIRPLANE NEWS).

In order to lay out the aerodynamic setup of factors accurately, mark first the center of gravity on your paper slightly to the left of the center of the sheet. The center of lift is to be above the C.G. Our next consideration is, how far above it. Stability is our chief consideration. Therefore, the center of lift should be quite high. One-sixth the tail moment arm is a good proportion under these conditions. Therefore, if the C. of L. is marked by a pencil dot two inches directly over the C.G., we have established the moment arm as twelve inches and a vertical arrow can be marked twelve inches to the right of the C.G. Fig. No. 110 shows you a sample layout which you can refer to as we proceed. From the C. of L. draw a vertical arrow upward to indicate the direction of the lift, and from the C.G. an arrow downward to show the direction of the pull of gravity on the weight of the airplane.

Next we can draw the line of thrust. This should pass *above* the C.G. in a horizontal direction and below the C. of L. When it is above the C.G., it causes a flat glide at the end of a flight and increases the longitudinal stability. Especially is it effective in minimizing stalling tendencies. If it is located as specified below the C. of L., it will pass usually through the center of resistance or near it. The center of resistance, generally speaking, is approximately 63 percent up toward the C. of L. from the C.G. You may indicate this by a horizontal arrow drawn 1¼ inches above the C.G., pointing to the right

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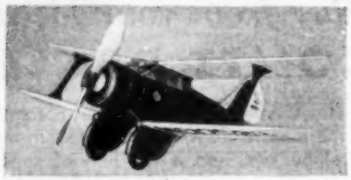

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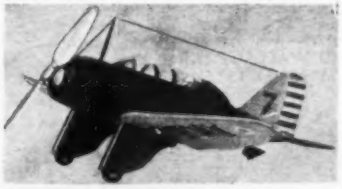

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on your layout.

Now if the line of thrust is located above the C. of R., then the plane will have a tendency to nose over under power unless a down pressure is produced on the stabilizer, by giving it a negative angle of incidence. Actually we wish the plane to nose up slightly into a climb when under power so the L. of T. should be slightly below the C. of R. If it is located halfway between the C.G. and the C.L., it will satisfy all conditions faithfully. Indicate it on your layout by an arrow pointing to the left and drawn horizontally, one inch above the C.G. It will then be ¼ inch below the C. of R. and one inch below the C. of L.

We should give consideration next to the position of the *point of thrust*. In reference to the structural mechanism of the model, this is located on the rear face of the propeller hub where the propeller shaft passes into the propeller from the bearing. It is the point at which the pull of the propeller is effective.

We have learned from our previous study of stability problems that this point should be as close to the center of gravity as the considerations of model balance and structure will allow. It is difficult to construct a plane so that it is closer to the C.G. than ⅛ the tail moment arm without adding extra weight to the "nose" of the model to create correct flight balance. At any rate, this is a reasonable proportion so we will consider that the point of thrust is four inches in front of the C.G. Locate it on your layout in this position for the time being at least. When considering the structural layout, it can be moved in nearer the C.G. if balance requirements do not make this impossible.

The stabilizer reaction will take place at the right hand end of the stabilizer moment arm and is indicated by the vertical arrow. This should point both upward and downward as for the present we will assume that the stabilizer will be placed in an approximately neutral position (zero°, parallel to the line of thrust) with the chosen set up of the L. of T, and the L. of R. If the L. of R. should happen to be located farther above the L. of T., the stabilizer would have to be set at a positive angle to overcome the nosing up effect of the L. of T.—L. of R. couple.

Now we have only one other consideration regarding the longitudinal stability of our model Is the center of lift to be located directly over the C.G., slightly to the rear (right) of it or ahead (left) of it? There is just one point to consider in regard to this. If it is back of the C.G. the stabilizer will have to be set slightly negative to produce the correct balance through the flight from start to finish. However, such a position usually produces a tendency to climb steeply and glide steeply. If the stabilizer is set at zero degrees (parallel to the L. of T.) with such a position of the C. of L., the climb will not be so steep as to cause a stall, but the glide will be still steeper This effect may not be pronounced in many models but at least less stalling and a flatter glide will result if the C. of L. is located slightly ahead of the C.G., approximately 20% of the wing chord

We do not know the length of the "chord" yet as we have not considered the

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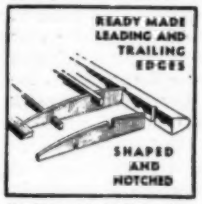

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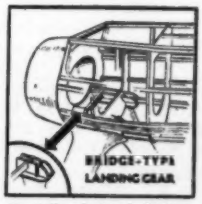

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structure of the plane. However, if the center of the wing is located directly over the C.G., the C. of L. will be about 20% ahead of the C.G. under normal flying conditions. Therefore, you may mark the point directly above the C.G.. now indicated by C. of L., as *"center of wing chord."*

In our aerodynamic layout, the factor which influences the directional stability of the model is the fin moment arm. If the fin is given the same length of moment arm as the stabilizer, it will be sufficient and in accordance with good practice. In this case it is twelve inches. In regard to the vertical disposition of the fin, we will follow standard practice and place it above the stabilizer. Thus the point of fin reaction may be located twelve inches to the rear (right) of the C.G. and about 1½ inches (⅛ moment arm) above the stabilizer. Indicate it by a dot on your layout and mark it F.R. (Fin Reaction.)

Lateral stability is obtained in this case to a certain extent by the high center of lift. However, as our plane is to be primarily a stable one, we will definitely establish this quality in it by giving it a dihedral angle of considerable magnitude in addition. An average amount is about one inch per foot of wing span. In order to insure lateral stability, suppose we specify a dihedral of 2 inches per foot of wing span. Later the practical application of this to a wing will be explained.

The position of the center of lateral area is the next consideration. As we explained earlier in this series of articles, the lateral area of a model is the area or surface that would meet the air if the model moved sideways at right angles to the normal direction of flight. It is the area of the projection of the airplane on a vertical plane. One might say it is the shadow of the airplane on a vertical surface held at the side of the ship parallel to the line of thrust. The center of lateral area is in effect the center of this shadow.

In a well designed speed ship, this center should be located about on a line drawn through the center of gravity parallel to the line of thrust or slightly above it. If it is too high, the ship will have a tendency to bank excessively on a turn and "dive in." The faster the plane is the greater the tendency will be. Slow ships which usually assume a climbing attitude under power are affected very little even if the center o. lateral area is high (well above the C.G.). In the case of the plane we are designing. its position is not extremely important as stability is our objective, which characteristic demands a fairly slow ship. However, mark a point on your diagram as the center of lateral area, on a line with the C.G. horizontally and about three inches to the rear or right of it. If a fuselage type of model is finally chosen for your design, it can be shaped so that the center of lateral area will come at this point. If it is decided that a stick model will suit your purpose better, the C. of LA will be slightly above the "best position", but due to the lack of flight speed its effect will be too small to overcome the action of the low C.G. (relative to the C. of L.).

Next month our discussion of design will continue.

Build and Fly This Boeing Fighter

(Continued from page 17)

The tail unit, including the fillets, were painted a solid red on the model. The lettering was done with white oil paint.

Center Section Struts, Wings and Interplane Struts

The center section struts are cut to the lengths required from ⅛"x¼" and streamlined. The ends are slanted before the struts are cemented in position.

The spars for the top wing are 1/16"x 3/16". They are pinned to the bench as evenly as possible. The ribs are cut from 1/32" sheet, pinned together and sanded to a similar outline. The notches are cut while the ribs are pinned together to insure their accuracy. Cement the ribs in place on the spars. The special tip sections required are shown on the wing plan in dotted lines. The leading edge of the top wing is ⅛" sq. stock, half rounded and cemented in position. The trailing edge is 1/16"x3/16" stock. The tips are 1/20" sq. bamboo, bent by candle flame to the desired shape. To incorporate the ¼" dihedral in the top wing, it is necessary to crack the spars and leading edge at the point of angle. The wing tips are supported at the proper height by small blocks until the cemented cracked portions have dried. There is no dihedral

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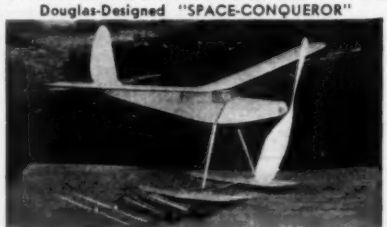
NOTE! These three kits contain glue, dope, tissue, rubber, shaped props, free wheeling prop, shafts, parts requiring machine work cut to shape. Other parts clearly printed on "AAA" balsa strips cut to size and M & M Model Wheels, pontoon parts also printed on sheet balsa for the "space conqueror."

Douglas-Designed "SPACE-CONQUEROR"



Wing span 36", length 27", wt. 2.8 oz. The new "Space Conqueror" Hydroplane, Landplane and Skiplane—all in one model—change from one to the other in two minutes. This model has an unofficial record of 19 min. 25 sec., 2500 ft. Altitude with M & M Model Wheels. And two to three minutes with pontoons and skis. It takes off just like a real plane, is very easy to build, and the flights it makes are really amazing.

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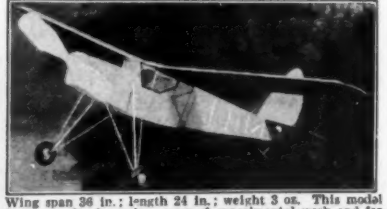
Douglas-Designed "FLYING CLOUD"



Wing span 36 in.; length 24 in.; weight 3 oz. This model is the result of nearly a year of experimental work and for consistent flying this model is in a class by itself.

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on the scale Boeing's top wing. The smallest degree advisable has been added to the flying model.

The lower wing panels are built one left and one right hand. It is necessary to slant the innermost rib of each panel to allow for the ½" dihedral. Small pieces of 1/16" stock are inserted between the two inner ribs of both panels to prevent their distortion by covering. The leading edge is 3/32" sq. The spars are 1/16"x⅛" and the trailing edge 1/16"x3/16".

Cover the bottom of the top wing with one piece of tissue. The top surface is covered with three pieces due to the dihedral angle. The top and bottom surfaces of both the lower wing panels are covered with separate pieces of tissue. It would be advisable to cover the tips with narrow strips to avoid wrinkles. The finished covering is lightly sprayed and doped. The upper surface of the top wing is colored yellow. Three inch stars are used.

The top wing is attached to the center section struts and checked for alignment. The lower wing panels are cemented to the fillets built into the fuselage. It is to be noted that the incidence of the top wing is 3/32" and that of the bottom 1/16". The interplane and aileron struts are cut to the required sizes, streamlined and cemented in position. The interplane struts are 1/16"x¼" and the aileron struts 1/16"x⅛". Fillets R and S are cut to the detailed size from 3/32" sheet. Black thread bracing wires are used. All load and lift wires are double. The remainder of the wings and all the struts are painted silver.

Drag Ring, Propeller and Motor

The drag ring is built up of six layers of 3/16" balsa sheet. Each layer is cut to the required outside and inside diameters and glued up cross grain. When dry, the contour of the outside is accomplished by shaping with a razor blade. A thorough sanding is done with fine paper. The main dimensions of the key layers are tabulated on the plan. The hole cut to receive the dummy motor or removable nose plug is square to prevent turning.

The crankcase proper is rounded from a block slightly larger than the 1½" sq. one actually required. The nine spacings for the cylinder attachments are accurately marked. The crankcase must be flattened slightly where each cylinder is to be attached. This is clearly shown in the motor detail. The three circular additions to the front of the crankcase are made from 3/16" and 3/32" sheets as required. The bearing shown is cut from tin and sunk in as well as cemented to the crankcase. The cylinders shown are built up of scraps. The lowest portion of the cylinder is 1/16" sheet. The piece immediately above is ⅜" in diameter and ¼" in thickness. The top of each cylinder is rounded as seen in the cross-section of the ring. The rocker arm housings are small pieces cut to shape and glued into notches cut in the cylinder head. The pushrods can be made by rounding 1/16" sq. balsa. The square plug piece at the rear of the crankcase is a piece of 3/16" sheet.

The propeller blank is cut along the diagonals that run along each side of the blades and extend beyond the confines of the block shown. These diagonals are for a block 2¼" wide. The excess portions are not shown on the plan. Do not shape the tips until the carving has been completed. Sand carefully after the balancing has been completed. The proper balance is essential to the performance of the model. The shaft is bent to shape from .028 wire. It is of course necessary to locate the shaft in the propeller, imbed a bearing in the rear face and to place a loose washer on the shaft as well as the plug before the hook is bent. The front of the shaft is bent U-shaped to permit its firm hold in the prop base. The prop is silver in color as is the drag ring and crankcase. The cylinders are black and the pushrods silver.

The motive power is eight strands of ⅛" flat rubber. Lubrication and winder winding will increase the flight duration if high performance is demanded.

Flight Directions

Balance the model by flying it over deep grass. If none is available, fly the ship on a few turns R.O.G. As the correct balance is ascertained, the number of turns is gradually increased. A small weight is invariably needed in the nose to balance the flying scale model despite

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1x2 1 for .15
2x2 1 for .20
2x3 1 for .30
2x6 1 for .45
18" Birch Dowels
1/8; 3/16; 1/4 dia. to
18" Bamboo
1/16x1/4
.01 sq. 12 for .10
Machine Cut Propellers
5" 3 for .10
6" 1 for .05
8" 1 for .07
10" 1 for .10
Hand Carved Propellers
5" .10 8" .25
6" .12 10" .30
7" .20 12" .35
Aluminum Props
1¼" long 6 for .05
1" to 2 in. 3 for .05
Celluloid Motors
1" dia. each .15
2" dia. each .20
3" dia. each .35
Balsa Wheels
¾" per pr. .04
1" per pr. .05
1¼" per pr. .07
1½" per pr. .08
1¾" per pr. .10
2" per pr. .12
2½" per pr. .20
3" per pr. .25
Celluloid Wheels
⅝" per pr. .07
¾" per pr. .08
1" per pr. .12
1¼" per pr. .16
1½" per pr. .20
1¾" per pr. .25
Celluloid Pants
For ¾" & 1" wheels per pr. .20
For 1⅛" & 1¼" wheels per pr. .45
Tweezers
Each .15
Brushes
Pointed .05
Flat ⅝" .10
Cast Metal Props
1½" 2 Blades .07
2½" 2 Blades .10
3¾" 2 Blades .20
1½" 3 Blades .08
2½" 3 Blades .15
Aluminum Motor Nose Plates
⅝" for 1¼" Motor .08
1¼" for 2" Motor .10
1¾" for 3" Motor .15
Cast Guns
1" each .05
1½" each .08
2" each .10
Cast Guns with Ring Mount
1½" each .20
2" each .25
Bombs
⅝" each .05
1¼" each .10
Wing & Tail Lights
Small 3 for .10
Medium 3 for .20
Large 3 for .35
Hair Wire
34 gauge, per spool .10
Metal Fittings
Wing Clips
Large or Small 2 for .05
Prop Hangers
Largeor Small 2 for .05
Rear Hooks
Largeor Small 2 for .05
Steel Beads
Per doz. .05
Washers
⅛" dia. per doz. .05
¼" dia. per doz. .05
¾" dia. per doz. .05
Jap Tissue
White 2 for .05
Colored each .05
Black, Orange, Red, Yellow, Green, Brown, (new) Silver
Rubber Motors
.045 20" for .10
1/16 sq. 25" for .10
1/32x1/16 25" for .10
1/32x3/32 25" for .10
1/32x1/8 25" for .10
1/32x3/16 25" for .15
Music Wire
Coils or straight 1 ft. lengths, .014, .024, .028, .034 10 ft. . .05
National Cement
Tube .05
1 oz. bot. .10
1 pint can .75
Clear Dope
1 oz. .10
1 pint .75
Colored Dope
1 oz. White, Black, Orange, Brown, Olive, Blue Gray, Red, Green, Yellow .10
Corrugated Paper
Yellow, 4x5" .03
Acetone
1 oz. .05

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Always looking ahead, creating advanced features, National's models are right in line with the New Year, prepared to outclass and outperform as they always have, but with even greater records than ever before. National Kits are priced from 25c to $5.00. There are solid and flying models, scaled in detail to ¼", ½", ¾" and 1". See them at your dealer or order direct.

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Also, ½" Boeing P-26-A, Fokker D-7.

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Plus Postage 10c

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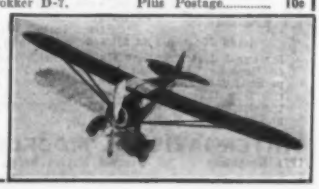
New ½" scale Model. Span 18". Lgth. 10.15". Wgt. ¾ oz. Colors; red, black trim. Realistic and a thrill to fly. 25c
Plus P. P. 10c
Also in this group are 18" Corbin Ace and Taylor Cub and 12" Curtiss Robin, Heath, Fokker D-8, Puss Moth.



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9 in. each	20c	15c	35c
10 in. each	22c	20c	40c
11 in. each	30c	25c	45c
12 in. each	35c	30c	55c
13 in. each	45c	35c	60c
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all the possible methods of design and construction unless the proportions of tail surfaces are interfered with. Though the F4B-4 has a short rubber length, it is capable of flights a few hundred feet in distance if accurately built and wisely flown. You are bound to be pleased with the unexpected distance and stability of this little fighter.

Bill of Materials

1—1/16"x2"x24" sheet balsa Bulkheads.
1—1/32"x2"x24" sheet balsa Wing ribs and cockpits.
1—3/32"x2"x24" sheet balsa Auxiliary gas tank. Former stringers, strut fillets and tail wheel mount.
1—3/16"x2"x24" sheet balsa Drag ring.
7—1/16" sq.x36" strip balsa Stringers.
3—1/16"x3/16"x36" strip balsa Top wing spars and all trailing edges.
2—1/16"x⅛"x36" strip balsa Bottom wing spars, aileron struts and tail spars.
1—1/32"x⅛"x24" strip balsa Tail crosspieces.
1—⅛"x¼"x36" strip balsa Landing gear and center section struts.
1—1/16"x¼"x24" strip balsa Interplane struts.
1—⅛"x⅜"x6" strip balsa Landing gear.
2—1 1/16"x1"x1 1/16" Block balsa Fillets Y.
2—1/16" sq.x1 1/16" block balsa Fillets X.
2—5/16"x⅝"x3 1/16" block balsa Stabilizer fillets.
1—1⅝"x⅜"x1 3/16" block balsa Block Z.
1—1⅝"x¼"x3/16" block balsa Rudder post.
1—1½" sq.x½" block balsa Crankcase.
1—8½"x1½"x1 1/16" block balsa Propeller blank.

Miscellaneous

1—1 oz. cement
2—sheets white tissue
1—pr. 1⅝" wheels
1—ft. .028 music wire
1—⅛" washer
1—scrap sheet celluloid
8—ft. ⅛" flat rubber
1—2 oz. clear dope
2—unsplit bamboo (¼"x1/16")
1—½" tail wheel
1—3" .014 music wire
1—scrap tin for bearings.
Black thread for bracing
1—1 oz. yellow paint (laquer or dope)
1—1½oz. silver paint
(bronzing powder and dope)

On the Frontier of Aviation

(Continued from page 11)

about 198 m.p.h. and have a range of 800 miles. Landing speed will be 45 m.p.h. The power plant will be a seven cylinder Wright Whirlwind of approximately 300 hp. There will be room for four parachutes and all necessary baggage. Split trailing edge flaps employing a special automatic control will be used. When the pilot slows the speed of the plane for a landing the flaps automatically drop down. If the pilot then decides not to land, he gives the plane "the gun" and the flaps automatically come up into the wing again. However, they rise very slowly so as to keep the plane from stalling. The first of the Howard sport planes was expected to be completed during this or next month.

Department of Commerce load testing has been completed on the Brown B-3 sport plane, another example of what the National Air Races has given to the commercial aviation industry. Construction of the plane has been delayed slightly to await the completion of a new 300 hp. engine that Menasco is about to add to its line of famous aircraft engines. Both Brown and Menasco are located in Los Angeles, California. Details of the Brown sport have already been published in past issues of this paper. The first of the B-3s, however, will differ from the standard line that will be produced by having only one cockpit. In place of the other cockpit, a large gas tank has been installed for cross-country flights. A sliding glass cowl will enclose the single cockpit. The B-3 has been stressed for 225 m.p.h. Ground and ball bearings are used on all controls. One unique feature of the little plane is that all control cables and horns are within the fabric surfaces. Tabs are employed. The fuselage carries 65 gallons of gas and 8 gallons of oil, with 10 more gallons of gas in the wing. Span is 31' 10½", length 25' 10½", and gross weight is 2,300 lb. The wheel pants are five feet long.

One of the most outstanding features of the plane is that Handley Page slots and flaps are to be employed. The B-3 will be the first commercial modern American airplane to use slots. The Curtiss Aeroplane and Motor Company has been the only other user of Handley page slots and flaps in this country. The majority of their military planes are equipped with them, including their new A-14 twin-engined attack ship which is now at Dayton, Ohio, undergoing U.S. Army Air Corps tests.

Another likely user of the slot is the Timm Aircraft concern. They will employ it on their new twin-engined transport now under construction and also on a proposed Navy transport for aircraft carriers. The Timm commercial transport is said to have undergone slight revamping since its first details were made public.

The Brown Company has contemplated construction of a twin-engined racer like the DeHavilland "Comet." Two Menascos would be the power plant.

Another plane on the drawing boards of the Brown Company is an Army training ship. It will be a two-place (in tandem) low-wing monoplane of the same general lines as the "Miss Los Angeles."

Work on the Brown Thompson racer was halted on the death of Roy Minor for whom it was to be built. However the designing of the ship has been completed and the company expects to go

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ahead with the construction of it soon. A new 1,000 hp. engine that has been secretly guarded by the Navy has been allowed to be put in the plane when completed. The ship is expected to compete in the National Air Races of the future, but will not be allowed to accept any cash awards because it is partly a Naval project.

The Kinner Airplane & Motor Company of Glendale, California, have developed an improved version of their Sportster.

A new Skylark much resembling the Kinner low-wing planes has also made its appearance. Its first public showing was at the Long Beach Women's Air Races that were held last month. The swift-looking plane is powered by a Warner engine enclosed in a full N.A.C.A. cowl. Pilot and passenger seating is side-by-side.

In the middle West in Robertson, Missouri, the Curtiss-Wright Airplane Company has once more come to life after some extensive experimentation. Latest of their products is a very much advanced version of their 1929 Coupe. In its early stages of development, this plane was known as the Sparrow, but evidently according to Curtiss-Wright's public announcement, the name has been changed to "Coupe."

The ship is an all-metal two-place low-wing monoplane with fixed slots. Flaps are 70% of the wingspread in length. This has been made possible by allowing the ailerons to operate only in an upward position.

Top speed is 131 m.p.h., cruising 115 m.p.h., and landing speed less than 40 m.p.h. It climbs at 500 feet per minute and has a range of 496 miles at 20 miles to the gallon. Wing span is 32 feet, length 25 feet 6½ inches, and height 7 feet 2 inches. The power plant is a 90 hp. Lambert engine. Most important of all, it has been designed for mass production! It is stall-proof and spin-proof.

But the Curtiss-Wright Coupe is only a minor project in the company's huge development program. More startling news is that Curtiss-Wright is progressing with a new transport, an all-metal low-wing for the sub-stratosphere. Rumors have placed the capacity between thirty to forty passengers! The cabin of the huge plane is said to be stressed for about 30,000 feet altitude. Enormous speeds should be attained at that height.

Possibly before this year has ended, a 2,000 hp. engine will have been developed. Details are not available, but watch closely for public announcements of various new engines of unbelievable horsepower that may appear in the not-so-far future. They are now well in the course of development, and when completed they will begin a new era in aircraft design. Thus more progress for aviation in 1936!

How to Build a Replica Model of Miss Jacqueline Cochran's Northrop Racers

Just prior to the London-Melbourne MacRobertson Race in October 1934, a swift new Northrop two-place racer was completed for Miss Cochran to be entered in that greatest of all air races. Unfortunately a crack-up after a trans-continental flight prevented the plane from competing in the race. The ship, when originally built, contained a liquid-cooled Curtiss Conqueror engine.

Many months later the Northrop was hurriedly rebuilt in order that it might be entered in the 1935 Bendix trans-continental race. In place of the Curtiss Conqueror engine was installed a Pratt & Whitney Wasp Jr. engine of much higher horsepower than the Conqueror. The two-place cockpit was changed to a one-place cockpit. They were the only major changes in the original design and they are shown on the accompanying plans.

Miss Cochran dropped out early in the Bendix Race because of bad weather and trouble with her radio, and for that reason the large plane has not as yet been able to show its high performance as a long-distance racing ship.

Get dimensions for stock from plans. Balsa wood is easiest to work with and it may be purchased in any model shop or popular department store. If you wish to square-off the plans for simpler means of measuring, connect the corresponding dots on the border with straight, neat pencil lines. Each square equals ten inches.

Make the fuselage first as that is the most difficult part of the model. Draw the outline of the side view and cut with jig-saw. Then top elevation and cut again. Then round off the corners as shown by cross-sections with razor blade and chisel. Note that cross-sections A-A and B-B are for Curtiss Conqueror

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model only and section C-C for either model. Go over surfaces with coarse and then fine sandpaper, giving a very smooth finish.

Make the wing next. Draw outline of top elevation on stock and cut to shape. Taper down the wing as shown in front view of model with a sharp chisel. Then give the wing the true airfoil shape as shown by the two wing sections. Sandpaper thoroughly.

Cut slot in belly of fuselage to fit wing.

Shape out the tail surfaces next. Draw their outlines and cut with razor blade. Streamline them and then sandpaper. Using a soft lead pencil and pressing heavily, draw lines separating fin from rudder and stabilizer from elevators. Also outline the tabs on the tail units and the ailerons on the wing.

The pants for the landing gear may be made in the same manner as the tail units. Hollow them out so the wheels may fit. It is best to purchase the wheels. Use straight pins as axles.

With your razor blade shape out the airspeed indicator and the prop and also the radio compass loop antenna if it is the Conqueror-powered Northrop you are building. The antenna is most easily made out of a piece of flattened copper wire.

Then begin the assembly. Fit wing into slot in fuselage and join with plenty of ambroid. Putty may be used for making wing fillets. Connect pants to wing and tail wheel to tail of fuselage. Use piece of wire as tail wheel strut.

Put prop in the nose, using a pin as shaft. Then put on the airspeed indicator and loop antenna. Go over all joints with ambroid and then sandpaper the entire model with a fine grade of paper.

Brush off all dust and begin the paint job. The entire model is to be painted silver except windows which are to be white and engine (Twin-Wasp model) which is to be black. Tires on wheels should also be black. Give the model many coats in order to obtain a smooth finish. Do not apply one coat until the previous one has dried. On the Wasp Jr. powered model, a red arrow with the insignia of a rabbit may be painted on after the silver coats have dried thoroughly. The model or models will then be completed.

Airways—Here and There

(Continued from page 15)

models. There was also on hand a wind tunnel for testing models and a large number of kites which were used for releasing models at various altitudes. The largest model present was that of a tailless glider built by N. Ziurin of Moscow, which had a span of 15.7 feet and weighed over twelve pounds.

If anyone wishes general specifications of models presented at the All Union Meet by the aircraft builders, we will be pleased to give this information to those who care to write to us, enclosing a self-addressed, stamped envelope.

Czechoslovakia

Sometime ago we published a picture sent from Czechoslovakia by Arnost Klein. Picture No. 10 shows Klein busily engaged in winding a model at a recent contest held in that country. President F. G. Masaryk sent the picture to Stephen Kunak, who lives at 1365 First Avenue, New York City, % F. Wolak, who was kind enough to send it to MODEL AIRPLANE NEWS. It has taken rather a round-about journey to get to these pages, but possibly that increases its value rather than detracts from it. President Masaryk is the elderly gentleman indicated by the arrow, shown watching Klein while he winds his motor. This verifies an old adage in regard to model work. It is, "model flying is a sport for young men from ten to seventy."

From the size of the gathering at this contest, we would say that the interest in model airplane activities in Czechoslovakia was extremely intense. Members of the club which staged the competition, are extremely interested in hearing from American model builders. When writing, address Arnost Klein, Libensky Modelovy Krouzek, Prague X-Karlin Lollarova 7, Czechoslovakia.

New Zealand

One would hardly think that young men in New Zealand would be interested in building models. However, this activity has reached a large stage of development in that country. A society of model builders flying clubs has been formed, called the Tanaranki Union of Model Flying Clubs, which has organized the builders of the clubs established in various localities. These clubs hold contests regularly and get together periodically for a grand contest in which the clubs compete. Mr. Gordon P. Smith of Brougham Street, New Plymouth, New Zealand, is the secretary. He writes us of a new club which has recently been formed and is a member of the Union.

This club is in the Okato Domain and held its first flying meeting on Saturday, October 12th. For a starter, twelve young men competed under the supervision of the secretary, C. M. Smith. The winners of the various sections were:

Spar Models Distance—J. Dunn flying an

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Eaglet plane
Spar Models Endurance—J. Dunn flying an Eaglet plane
Fuselage Endurance—F. Edwards with his Eagle
Fuselage Distance—F. Edwards with his Eagle

K. Shaw was unfortunate in the contest but later caused great excitement by giving an exhibition of "crazy flying" with a special stunt model. This club sent delegates to the large contest which was held at New Plymouth on October 26th. We are sure that members of this club will welcome letters from American builders.

CLUB NEWS

Indiana

Our educational system is gradually coming to recognize the value of model airplane designing, building and flying as an instructive activity. One of these progressive schools is Lincoln High School of Vincennes, Indiana. It is probably one of the most air-minded schools in the United States in proportion to the number of students entered.

At present there are seven boys in Lincoln High, ranging in age from thirteen to sixteen, who have three or more hours of solo flying to their credit. Jimmy Funk, 13, is the youngest and Joe Kleymeyer, 16, star athlete, is the oldest.

The Lincoln High Solo Club is the outgrowth of a model airplane club, The Heights Flying Club, which was organized three years ago by Jack Reed. The club built many models some of which captured prizes in open competition. The boys are unanimous in the opinion that building models taught them the principles of operating a plane and made instruction at the flying field easy to understand. The boys got their instruction and solo work at the O'Neill Airport near Vincennes.

Picture No. 11 shows the Lincoln High School Solo Club, whose members were formerly model builders and now have taken up flying. We are indebted to George Randall McCormack of 522 South Tenth Street, Vincennes, Indiana, for this information.

California

The Aviation Advancement Club of 2922 Adams Avenue, San Diego, Calif., has been operating for almost two years. At present the membership is seventeen. Each month the club holds a contest as well as regular meetings, at which they have an Aviation Question Contest. At the end of four meetings, prizes are awarded. This club has a thirty-eight foot primary glider which is flown every Sunday. Club records for different types of models are:

Flying Scale—55 sec.; Commercial—1 min., 21 sec., Stick—1 min., 37 sec.; Glider (tow launched) 9 min., 25 sec. (out of sight, no binoculars); Detailed Scale—83%.

They are trying for a National Aeronautic Association chapter and would appreciate hearing from anyone interested. Write to Jack Emry at club headquarters, at the above address.

Georgia

From Charles Baily, Corresponding Sec-

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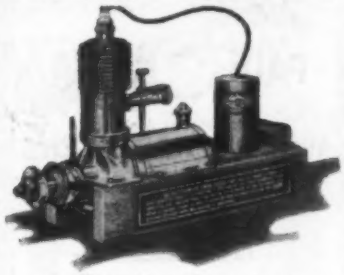

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Ask your dealer for Whitfield's props, motors and tissue. Our money back guarantee goes with all our supplies.

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retary of the Atlanta Model Airplane Club, sponsored by Miller's Book Store of 64 North Broad Street, Atlanta, Georgia, comes the following information:

"The Atlanta Model Airplane Club held its first Indoor Contest of the year on October 12th, in the City Auditorium. Although the times made would not compare with the national records, still they show a marked improvement over the present club records. This is only the third indoor contest the club has ever held and the members consider themselves just about beginners in this field of model building.

"The City Auditorium has a ceiling of only 40 ft. at the upper end and 50 ft. at the lower end, due to the sloping floor. Flying room is about 110 ft. in length and breadth. Due to this handicap, the following times are good:

Junior

Glider (Class A)
1. Clark Adair 0:24:0
2. Donald Kimsey 0:15:5

Stick (Class B)
1. Dan Womack 4:41:5
2. Clark Adair 1:41:0

Fuselage (Class B)
1. Clark Adair 6:10:4
2. Donald Kimsey 3:11:4

Senior

Glider (Class A)
1. Charles Baily 0:26:7
2. Leslie Adams 0:21:0

Stick (Class B)
1. Charles Baily 5:25:5
2. Frampton Ellis 4:51:0

Fuselage (Class B)
1. Carl Buck 3:25:8
2. Charles Baily 3:14:8

"Herbert Stephens, a Georgia Tech student and an associate member of the club who specializes in designing orthopters and ornithopters, had one of his most successful models with him. He succeeded in getting one very beautiful flight of 24 seconds, during which time it actually climbed and flew around the auditorium.

"The club would be glad to correspond with all or any of the other clubs in the country; just write us a letter and tell us what you are doing and we will be very glad to reply."

Massachusetts

We are glad to see that one of the most progressive clubs, the Jordan Marsh-Boston Traveler Junior Aviation League, of Boston, Mass., has taken one of the most progressive steps in regard to club programs. A class of original design has been started by the J.A.L. This class is for those who wish to experiment with original designs. The models which are taken up are those which incorporate some new or unconventional idea, such as; tailless type, autogiros, free-wings, ornithopters, rotorplanes, helicopters, rocket ships, etc.

The trend of our civilization today is to standardize on definite lines of procedure. Model airplane clubs are not immune to this influence and it is therefore exceedingly encouraging to realize that progressive clubs are keeping their minds active and open to new ideas, as is the J.A.L. After all, the whole value of model airplane designing, building and flying is that which is received from thinking out original problems, problems in which a young man's initiative is required. Thus, valuable qualities of character are developed which will help to establish him above the ordinary in his future life.

Perhaps many of our readers have been at contests where "queer looking contraptions," as they are called at the time, have been brought up to the starting line. Perhaps a snicker or a laugh or two has risen from the more orthodox model builders. Many times these peculiar aerial arrangements do not operate, but occasionally one is brought forth that startles the staid old model builders into more progressive channels of thought. To the creators of these brain children, the greatest homage should be paid. The ordinary model builders merely follow along the beaten path. These model builders have actually used their brains to create something new. The essence of progress lies within this capacity.

In model building, two types of work are required. (Note. Old staid model builders and other model builders who feel they are well up in this art, please notice.) First, mental work in which ideas must be corralled and so arranged that a practical model may be built. Second, the execution of these ideas or the material expression of them must take place. To size up various model builders is the life of these two factors, how many model builders today have original ideas? Most of their ideas are copies of other creations, slightly modified. Most of the model builders excel in workmanship, that is, old ideas expressed in exceedingly fine manner. Every credit should be given to the young man who strikes out from the beaten path to investigate some new angle of aviation. As a rule he must run the gauntlet of hard work and ridicule from others who believe that he should conform to standard practices. Our belief is that one original idea is worth a thousand records.

The rules under which the Junior Aviation League Original Class operates, are as follows:

Construction

1. Models must be of original design, designed and built by the entrant.
2. Models must be built with accommodations for at least one person.
3. Models must have double surfaced flying surfaces and at least 90% of the fuselage covered.
4. Models may have outboard motors which need not be enclosed.

Flying

1. Models must be launched R.O.G.
2. *Three* best flights of *nine* are allowed.
3. Only one model may be entered by one contestant.

Point Flying

1. 1st place —50 points + time
   2nd " —40 " + "
   3rd " —30 " + "
   4th " —20 " + "
   5th " —10 " + "

These points are given for duration.

2. 1st place —50 points
   2nd " —40 "
   3rd " —30 "
   4th " —20 "
   5th " —10 "

These points are given for originality of design. Models must fly 10 seconds R.O.G. to qualify for this rating.

Ohio

A letter comes from Edwin MacGregor of 1502 Linden Avenue, Springfield, Ohio. He says:

"We are just beginners and don't know much about planes or building planes, but we have just started our club. We are called "The War Birds." The members are: Edwin MacGregor, Captain, and Ray Murphy, Lieutenant. Bob Glass and Jack Miller are Sergeant and Corporal respectively. Don Roush is Private. We will be glad to correspond with any other clubs that will write us. Please address all correspondence to the Captain. Our club started on October 5th, 1935."

New York

Leon F. Kubinski of 859 East Church Street, Elmira, New York, a member of the Elmira Gliding Club, writes as follows:

"On September 17th, the Elmira Gliding Club began a series of twelve weekly meetings, to be known as a glider ground school. This course is free to anyone interested in learning the basic principles of aviation, and especially of motorless flight. At each session, three subjects are discussed in three lectures of a half hour each. Following there is an open period for questions and discussion. Some of the subjects on which talks are given are: aerodynamics, glider flight training, types of soaring and technique, meteorology, construction of soaring planes, and the use of short-wave radio in relation to gliding. In all the lectures the prime effort is to simplify the basic subjects in such a manner that they can be easily understood. The talks are by the different members of the gliding club.

"The sessions are attended by approximately fifty, mostly boys and girls of high school age. They are held at the local Y.M.C.A. on Tuesday evenings.

"In conjunction with the lecture course, those who attend are given the opportunity of observing at first hand the regular training and flight activities of the club, and of asking questions and getting a practical demonstration of the different phases of this great sport.

"The Elmira Gliding Club was a participant in the soaring expedition to the Blue Ridge Mountains which was held by the Soaring Society of America at Big Meadows, Virginia, from September 28th to October 13th, 1935."

Aviation Advisory Board

(Continued from page 28)

possible and yet have the airplane fly.

Though diminutive proportions of the tail surfaces have taken away from the stability qualities of the plane to a certain degree, in a large airplane control and recovery to normal flying position may be obtained by the manipulation of the controls by the pilot. In other words, instead of making the *area* of the stabilizer large enough to be effective, the pilot increases the *angle* by pulling down or up the elevators. This increases or decreases the lift or depression effect upon the stabilizer to an amount equal that caused by the stabilizer of large area without movable controls or controls being moved by the pilot.

In a model there is no pilot. Therefore, the stabilizer must be very much larger so that it will produce an effect, due to its large area, that in the large airplane is produced due to the increase in the angle of the elevators. Now it is obviously due to this fact that the large airplane is stable only when the pilot is capable of operating the controls. In other words, it is controllable not stable in itself, for if there were no pilot in the airplane, the machine would not fly but would crash.

On this basis, if large airplanes should be endowed with large stabilizers, then the plane would fly itself while the pilot would merely have to direct its course, not manipulate the controls to cause recovery from displacement. This the airplane would do itself.

We hope that this will give many readers an insight into the qualities which are lacking in most of the present day airplanes, where stability should be considered of prime importance.

As an example we cite the crash of the Boeing *299* which was reported by

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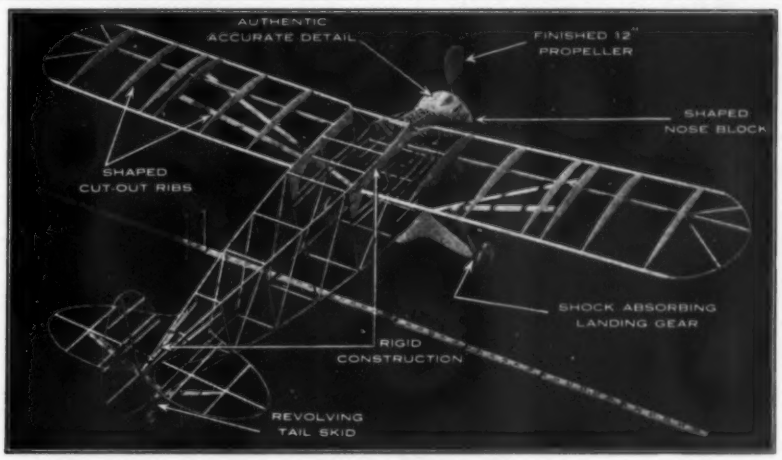

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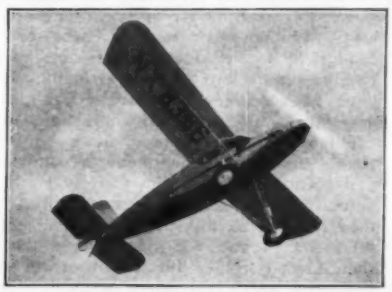

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military authorities to have taken off with the controls locked. The ship in itself was not sufficiently stable to fly without the pilot making corrections through operating the controls. If the Boeing 299 had sufficiently large tail surfaces to make corrections due to their area rather than because of an increase in the angle of the elevators, it would not have crashed, in our opinion. It would have been able to make its own corrections from displacement.

Here is another question which has caused much debate and many heated arguments. These have resulted from a lack of understanding of the situations. J. Morley Jackson of Bloomfield, Ontario, Canada, says:

"After seeing the Curtiss Hawk P6-E and the Hawker Super Fury perform, I believe that the Hawker Super Fury can out-perform the P6-E in every way."

Answer: There is no question about this matter at all. The Hawker Super Fury as it is designed can out-perform the P6-E, as he says. There is one little point, however, which Jackson has blandly overlooked. That is, that these airplanes should not be compared in any way in the first place, for they have been built for two entirely different purposes. One would hardly compare the speed of a motor-boat with an ocean liner, or a boy on a bicycle with an automobile.

In order to understand this, let us outline the purpose of each one of these ships which the designers had in mind when they were created. The Hawker Super Fury primarily is an airplane which has been intended to repel attacks from enemy squadrons; an intercepter fighter. In other words, it is supposed to climb quickly to a high altitude, fight the enemy over any given locality and return by dropping down to its airport again. This means that the fuel supply that it carries and its radius of action is very small indeed. The time that it is required to be in the air is not important in these maneuvers. The airplane, therefore, can be made extremely light with a high power engine, and the required military load is insignificant.

Now, on the other hand, the Curtiss P6-E is supposed to be able to perform reasonably well under trying conditions away from normal airports if necessary. It must fly for considerable distances, remaining in the air for several hours. It must be required to meet varying circumstances of combat which it may encounter. In other words, it must be rugged and it must carry heavy armament and plenty of fuel. The Curtiss Hawk actually carries a much heavier military load as well as a load of gasoline and oil for a flight three times longer than the Hawker Super Fury. In order to carry this heavy load, the whole structure of the airplane must be made proportionally heavier. Thus we have a very much heavier airplane in the Curtiss P6-E than in the Hawker Super Fury, not only due to its extra load but due to its extra structure. It is just a case of plain mathematics after this to ascertain which is the better performer.

Naturally, the lighter airplane will out-

(Continued on page 48)

"Gas Lines"

(Continued from page 8)

it flew into a lake near the airport after the motor stopped. No damage was done, however.

We have had many interesting responses from the request for information concerning gas model activities. In answering the following question in the Gas Model History slip which was printed in the magazine, several young men gave their candid opinion which upholds our point of view that gas model flying is one of the greatest boons to model fans. The question is: What do you think of this activity? Arnold Kerin of 353 Beekman Avenue, New York, New York, writes:

"From an aerodynamic point of view the builder who contemplates building a gas job is laying his foundation for future aeronautics in which he is likely to play a most important role; mainly because the construction of gas powered planes involves aerodynamics and many structural phases of design which so closely resembles its big brother.

"For a person who wishes to increase his technical vocabulary in relation to aerodynamics and who has always dreamt of building his own ships but could not afford it because of financial difficulties, the gas model solves the problem."

Kerin voices the opinion of many other builders, as expressed in the Gas Model Histories sent in. In all the letters we have had from gas model fans, we have not had one in which they stated that they would like to see the activity discontinued. Most of them felt that very little danger was entailed in the operation of gas jobs.

Frederick Pilcher, Jr., of Rochester, Minnesota, has been kind enough to tell us that he has completed one gas job of original design with which he has made almost one hundred flights without any crashes. He is looking forward to the time when smaller engines will be available. No doubt, Mr. Hungerford's development will interest Mr. Pilcher.

Mr. J. G. Wheeler of 966 Bank Street, Victoria, B.C., Canada, expresses his opinion as follows:

"I think that gas model activities mark the greatest advance in model aeronautics. There has always been something lacking in the rubber powered models. I hope that the trend in gas models will be for small, inexpensive models, which will enable the younger builders to compete sooner than they otherwise could."

We received a very lengthy and interesting letter from George H. Warden, Manager of the Pennsylvania Technical Institute of Locust Dale, Pa., P.O. Box 16. He has been kind enough to fill in the Gas Model History blank and send it to us. He says he has built seven gas models and is keeping an aircraft log and a gas engine log of each flight. He says he feels it is a priceless bit of information with regard to the condition and nature of the flight.

Mr. Warden has constructed a model of the Loutrel Speedster, with which he

had considerable success. He has also built the following models: a low-wing monoplane suitable for either compressed air or gasoline motor, which was an experimental affair and five models of different designs, two being sea-planes, one of which was a replica of the Macchi-Castoldi. It has a span of seven feet, six inches, the length of the floats being fifty-five inches. This ship required a long take-off and a suitable place was not available, hence a good many crashes resulted. The other three were land-planes. One was a replica of the Boeing 247, which ship was not particularly stable as it was heavy and he experienced difficulty at keeping the motors at the same revolutions per minute. He is now building a model of the KG-1.

Mr. Warden also says that he will be glad to offer any information of the above models to anyone who will write him for it.

He says he would like to see organized a club with local chapters composed of members interested only in gas powered models, and dues to be paid in order to create a fund for a national contest and cash prizes. The MODEL AIRPLANE NEWS office is suggested as the main office and headquarters. Rules and regulations should be drawn up and records made and broken in speed, endurance, height, weight-carrying, etc.

This last paragraph is particularly interesting, inasmuch as such a club is being planned, details of which are given further on in this article.

We received a letter from only one model builder who was not entirely in favor of gas models. He is Harry S. Tice of 618 West Jackson Blvd., Chicago, Illinois. He says:

"To be perfectly truthful, gas models mean less than nothing to me. I am not interested in them and probably never will be for the following reasons:

1. Too great an expense per model. I can't afford it now and since I'm Scotch I probably never will afford it.

2. Too great size. The gas models are unwieldy and cumbersome and are almost impossible to transport without an automobile.

3. Too great a weight. The only element of danger entering into my reasons is the danger of such heavy models cracking up on landing, and cracking up for good. I can supply documentary evidence in proof of this last statement. (Note. Evidently Mr. Tice has not been fortunate enough to obtain accurate and correct data on design, for when a gas model is properly designed few crack-ups result. There are many gas models flying today which have been flying for two years without major repairs.)

4. I am interested in compressed gas motors."

Probably this last remark of Mr. Tice is significant of his philosophy. However, we believe that if he builds a gas model that really performs well his interest will be much greater. He gives some interesting data concerning his compressed air model. He says:

The complete power plane including one cubic inch of fuel (1 oz. solid carbon dioxide) weighed 1½ oz. including the four-bladed propeller. The amount of fuel was sufficient to run the motor for almost two minutes driving the four-bladed propeller at 1500 revolutions per minute, fast enough to make the plane climb for the whole duration of the fuel supply. This plane was accidentally destroyed before any test flights were made but a second plane was finished a week ago and on the first calm day test flights will be made.

"This second plane is a Beechcraft B17-L and in gliding tests the actual L/D ratio is 25 to 3 or a trifle more than 8 to 1.

"The specifications on this plane are as follows: The span is 26 inches and chord is 4⅛ inches. It is 18¼ inches long. The weight without motor assembly is 1¾ oz., and with motor, generator, tubing, cowling is 1½ oz. A 6⅞" three blade prop (scale diameter) weight is included with motor. Generator capacity of solid carbon dioxide is three ounces."

Following is a list of those who have sent in their Gas Model History. Let's make this list larger. Send in your History immediately to The Editor, MODEL AIRPLANE NEWS, 551 Fifth Avenue, New York City. Simply fill in and mail the coupon which appears at the end of this article.

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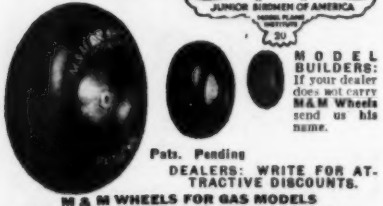

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"Gas Lines" unquestionably will help "gas" builders to get together. However, to facilitate this process MODEL AIRPLANE NEWS has undertaken to organize all gas fans under one banner.

It is proposed to form the International Gas Model Airplane Association. Its purpose will be to extend the activity of designing, building and flying gas engine powered model planes with the object of developing knowledge of aviation, familiarizing the public with common aeronautic practice and providing a means of enjoying a most beneficial sport.

Anyone can become a member. Only those who have designed or built and flown a gas model or have contributed to an important development can be listed as an active member, however. Clubs can become a unit member of the Association, each member of the club being listed on the roll of the Association.

There will be no dues, but assessments may be made by any Unit to carry on specified activities, only those participating in such activities to be assessed. The benefits will be many. First there can be an interchange of ideas through the columns of "Gas Lines," outlines for forming and running clubs and contests will also be supplied to interested units. Contests will be organized and held regularly and information on gas models will be available to members. Social events may also be sponsored. Any Unit may send a delegate to conventions to be held periodically for discussion of problems pertinent to aviation education in general and gas model activities in particular.

Membership pins and cards may be obtained later. Full information will be published soon. If you have any suggestions, please write and let them be known.

All readers who wish to enroll in this organization, the I.G.M.A.A., fill in the coupon below.

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Aviation Advisory Board

(Continued from page 46)

perform the heavier, within a restricted radius of action. There are two ways in which the Curtiss P6-E can out-perform the Super Fury and that is in radius of action, or distance travelled, and in dives. The Curtiss P6-E will stand up under a much greater diving strain than the Hawker Super Fury. After all, this is an important maneuver in combat work. Speed in combat work is only half the problem. Maneuverability is very important, and this quality the Curtiss Hawk has to a high degree. Whether or not it can compare to the Super Fury we do not know, as we have never seen both of these ships perform together. However, we suspect the Hawk would be able to hold its own in this respect.

We hope that this little discussion will clarify many misunderstandings concerning the relative performance of different types of airplanes.

Here we have some questions from Saul Bassin of 1574 Beach Avenue, New York, New York.

Question: Is the absence of the rudder on pushers due to the dihedral of the smaller surface?

Answer: No, for a rudder may be placed on a pusher even though it may have dihedral on the front surface. A rudder is not required on a pusher due to an entirely different reason. In *effect* there is a rudder on a pusher. The propellers offer a certain amount of effective area and due to their gyroscopic action, tend to hold the rear of the pusher steady while it is in flight. Thus the effect of a rudder exists, due to the propellers. After all, it is unimportant whether we have a rudder in itself on any airplane, for what we wish to have is the effect a rudder produces.

Question: How much dihedral should be used?

Answer: On a pusher it is advisable to have a dihedral on the rear wing which is equivalent to a rise of the wing tips to half an inch per foot of span. The dihedral of the front wing should be about two and a quarter times as much, provided the area of the front wing is between one-fourth and one-third of the area of the rear wing. If it is more than one-third, the dihedral should be only about one and three-quarter times this much.

Irving Pearlman of 2076 Belmont Avenue, New York City, wishes to know several fundamental questions on design. They are as follows:

Question: What is meant by aspect ratio?

Answer: Fundamentally "aspect ratio" means the span of the wing relative to the average chord. It may be determined by dividing the span by the average wing chord. "An aspect ratio of 7" means that the span of the wing is seven times the average width of the wing. When the wing is not tapered, the average chord length is the distance between leading and trailing edge.

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